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Delustering of Silk Hosiery

By LOUIS S. ZISMAN

Gotham Silk Hosiery Co., Inc.

HISTORICALLY, the search has always been for more luster. In 1844 John Mercer, a Lancashire calico printer while attempting to filter a concentrated caustic soda solution through a piece of cotton cloth discovered a peculiar reaction which was later developed and is now known as "Mercerization." This was the first step in developing true and permanent luster on a comparatively dull fiber such as cotton. While the mercerized cotton found very extensive and important use in partly replacing the prohibitively priced silk, it was rather limited where a true silk luster was required.

Before the vogue of dull fabrics all the efforts of textile manufacturers were bent on attempting to increase the luster of pure silk which has always been considered one of its most highly desirable characteristics. Consequently, up to a few years ago it would have been considered very unwise to deliberately deluster or dull the remarkable and beautiful sheen on a silk stocking. As a matter of fact, it was the expressed aim and wish on the part of "dipped dye" hosiery manufacturers to increase luster by the use of acids and various finishes in order to approach as far as possible the more lusterful and at that time commercially desirable appearance of "ingrain" stockings. However, when fashion dictated dullness it was necessary for hosiery manufacturers to remove the luster from their product, and this complete reversal of trend necessitated completely new methods of finishing.

Since nothing further could be done with the natural fibers, chemists directed their efforts to the possibilities of producing synthetic or artificial fibers. We know only too well of the startling discoveries that were later made which quickly gave birth to a great industry. The commercial use of rayon was rapid because of its great luster.

In processing the artificial fibers the thought uppermost in the minds of technicians was to reproduce as closely as possible the natural luster and sheen of pure silk. Because viscose and other artificial fibers were so much brighter than pure silk, the problem of reducing luster became very important. This led to the discovery of fibers possessing less luster than viscose but approaching very closely the degree of luster as in pure silk. Celanese or cellulose acetate silk is perhaps the best example. The relatively high cost of celanese in addition to recent requirements of even duller rayons terminated in the manufacture of permanently delustered rayons which was accomplished by the introduction of special chemicals in the spinning solution prior to the spinning operation.

Going back some years we note that the first silk stockings made on any large scale were of fifteen, twelve, and ten thread with plenty of cotton in hem and feet. This resulted in rather heavy cumbersome stockings as compared with the more fashionable numbers of to-day, yet at that time the heavy stockings were considered marvels of beauty that would grace any woman's ankle. The demand for very sheer stockings of fine gauge grew rapidly and with most women the sheerer the hose the better. Many began wearing their stockings inside out because they thought their hosiery looked sheerer. Incidentally it was evident that the rougher construction of the back side of the stocking was duller than the right side, and since this discovery accidentally coincided with the growing fashion demand for dull broadsilks, hosiery manufacturers quickly realized the need of reducing the luster of their product without making it necessary for the consumer to wear the stocking inside out, as this had obvious disadvantages such as an unsightly seam and the like.

Dullness in its true essence could be produced by the use of highly twisted yarns in the knitting operation, it having been known for a long time that increasing the twist (i.e., so many turns per inch of the single ends in one direction and so many turns per inch of the ply in the opposite direction) decreases the luster. Some of the more significant advantages gained by this method of dulling may be listed as follows:

1. Smoother and a more compact appearance of the stocking.
2. Less or practically no sleazy effects.
3. Less susceptibility to runs and pull threads.
4. Dull tone harmonizing better with fashion changes in other wearing apparel.

No sooner was the demand created for dull stockings than most manufacturers made preparations to ship the new article almost overnight. The rush was so great that

it was practically impossible to adjust machinery, prepare highly twisted yarns for knitting, and overcome many new manufacturing difficulties arising in the processing of natural dull stockings, with the result that chemical means were resorted to in the final finishing, following the dyeing operation.

In the earlier methods of dulling or delustering with chemicals almost anything was tried that might give a dull tone. Too little attention was given to the fine smoothness that any silk stocking should possess. The use of improper chemicals on the part of some finishers led buyers to be somewhat skeptical of all types of chemical treatments. This attitude was very unfair to those who had at great trouble and expense developed processes of dulling which not only delustered silk but improved the uniformity of structure without affecting the wearing qualities adversely.

One of the first methods for delustering silk stockings entailed the use of a mixture of finely precipitated chalk or impalpable talc with gums such as gelatine, gum arabic, and tragacanth. The talc was mixed in warm water with considerable agitation and applied to the goods to which a solution of gum was added. The latter acted as a binder holding the finely suspended talc on to the fibers. While this method imparted sufficient dulling it was hardly possible to get real uniformity or complete penetration. Furthermore, after drying the stockings the talc would have a tendency to dust off.

Various other combinations were later tried with the purpose of applying insoluble compounds that by themselves had some adhesive values. Barium sulfate, titanium salts, colloidal kaolin, or China clay, and any number of "Marketed Delusterizers" were used with more or less success, but in all cases the delusterants even after a high degree of technique in their application was attained proved to be only temporary, that is to say, the dulling would partly or wholly disappear in the first few washes.

Before suggesting a more permanent type of delustering process let us stop for a moment to briefly consider first, the physical phenomenon involved in dulling and secondly, the contributing factor in increasing smoothness and uniformity of fabric structure.

The delusterant when properly fixed on the fibers produces a great number of variant angles of reflection and when the eye meets the stocking the irregular angles of reflection seem to disturb the apparent brightness of the silk and a dull tone effect is brought to our senses.

On examining the loops of a tram silk stocking under the micro-analyzer we find that the individual strands are irregular and separated from each other. Any substance having the ability to contract or bind these fibers more closely together would have a tendency to straighten out slackened or distorted loops during the boarding or drying operation, thereby promoting evenness of knit.

The most satisfactory medium as a dulling agent should have the following properties:

1. Ability to emulsify.
2. Power to bind and fill.
3. Ability to penetrate well.
4. Resistance to washing off.
5. Leave a good handle in the stockings.
6. No injurious effect on stocking or skin.

Upon investigating many materials it was found that some of the solid waxes had very interesting possibilities, Colloidal Japan wax, although not a true wax, seemed to be especially adapted, principally because of the stability and uniformity of its emulsion.

A general method of applying the wax consists of first preparing the emulsion. This is perhaps the most important part of the procedure for the uniformity and permanency of the dulling itself depends largely upon the fineness and stability of the emulsion, which is usually prepared by pouring the molten wax very slowly and with constant agitation into softened water previously heated slightly above the temperature of the melt. The emulsion is then diluted and applied to the bath at 100°F. to 110°F. until the goods are well saturated, the hosiery is then extracted slightly and emersed into a fresh bath of alum or weak aluminum acetate solution. The method, incidently water-proofs or splash-proofs the stockings. Any degree of dullness can be had by regulating the strength of the emulsion bath and the time of the extraction period just before goods enter the setting bath (aluminum acetate).

While we cannot say that this method is totally permanent, experiments have shown that the stockings will retain their dullness after many washings, for assuming that the insoluble aluminum soap formed is gradually lost on continuous washings, there is left a certain amount of unsaponifiable wax which is not removable in ordinary laundering of silk stockings.

We do not wish to infer that even a well regulated and suitable method for delustering silk hosiery can take the place of naturally made dull silk stockings (knitted from highly twisted threads), but feel that some of the suggestions given in this article may be helpful in special cases where delustering of silk in any form is desirable as a finishing operation.

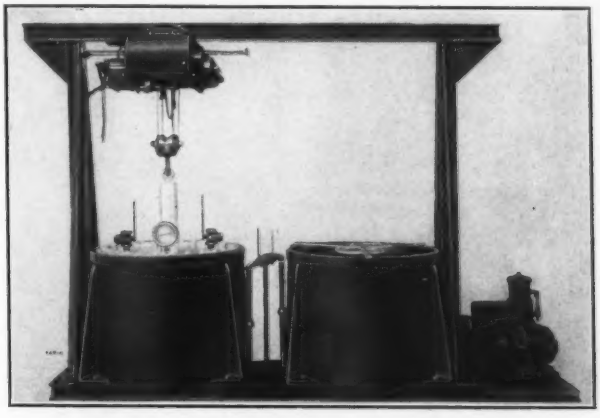
New du Pont Dye

The Dyestuff Division of E. I. du Pont de Nemours & Company has just announced the development of Pontamine Diazo Green GW, a dyestuff which when diazotized and developed with Pontamine Developer ZN, produces very brilliant shades of yellowish green. The color is recommended by the manufacturer for use on cotton, rayon and pure silk.

It is expected that Pontamine Diazo Green GW will find extensive use for application to cotton-rayon mixed goods due to the unusual property, which is claimed for it, of dyeing an excellent union on these fibers in full shades at temperatures near the boil.

Machine Soaking of Silk

By **FERDINAND J. CAYA**
Chemist, The Gotham Silk Hosiery Co., Inc.



Silk Impregnator of American Laundry Machine Co.

FORTUNATELY, the time is passed when silk soaking not only meant softening and lubrication, but also the weighting of silk, to make up for excess throwing waste, or even in some instances the actual boosting up of weight to allow for short deliveries.

The high level upon which commerce and manufacture have come to be maintained has resulted in making the softening and lubrication of silk, the sole purpose of the Throwster in soaking silk. Proper soaking is essentially important, to make the fiber more pliable, more easily workable and to impart specific properties, such as hygroscopicity, in order to meet the ever more exacting requirements of modern refinements in the manufacture of quality fabrics.

We may quite simply define silk soaking as a softening and lubrication of raw silk, by means of soaking in oil emulsions, preparatory to the processes of throwing, and the subsequent processes of weaving or knitting.

Former methods of soaking were often crude, as may be exemplified by the use of oil barrels converted into soaking tubs. At the same time the need of handling silk with the least possibility of injury to the fiber led in some cases to the ingenious adaptation of the household bathtub for this purpose. Later, conventional metal lined tubs, of convenient size, were generally used, the silk being submerged and allowed to stand for lengthy periods in oil emulsions.

The chief objection to the still baths has been, that uniform lubrication thruout a lot of silk, or even thruout individual skeins, was well nigh impossible. This was especially true when the emulsion was made from neatsfoot or olive oil with soap and alkali. This fact led to the development and use of sulfonated and specially compounded oils which would form more stable emulsions.

The purpose of this article, however, is not to pass on the merits of the lubricants. The ingredient formulation of soaking baths is still a debatable question, and may vary considerably in various mills, or according to the specific requirements of manufacture to which silk yarn is subject.

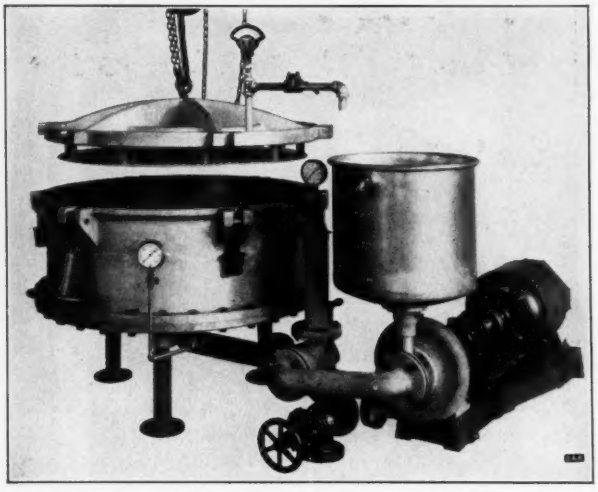
The fact remained that the need of more thorough penetration and distribution of the lubricant in, and on the fiber, called for soaking in an agitated bath, wherein the soaking emulsions would be forced through a lot of silk evenly and speedily.

Experimentation in machine soaking conducted for a number of years has resulted in the development of two distinct types of machines, namely, the impregnation-type, and the circulation-under-pressure type. Both types are applicable to this process of manufacture.

Of the first type, we may cite the American Laundry Impregnator, consisting of a round tub in which a hollow piston with a perforated bottom is made to slide. The silk is placed in the tub in layers, each layer being well sprayed with the soaking emulsion which is pumped from the mixing tank through a spray nozzle. The piston is then lowered onto the silk. A vacuum on the inside of the system, obtained by means of a suction pump causes the piston to press down upon the silk and forces the excess liquor through the perforated plate into the head of the piston. After a period of about three minutes, a maximum vacuum is reached. On opening valves located on top of the piston, and raising the latter, by means of a hoist, atmospheric pressure is restored and the soaking liquor which had been pressed through, and out of the silk, is allowed to seep through again. The process is repeated three or four times to assure thorough impregnation.

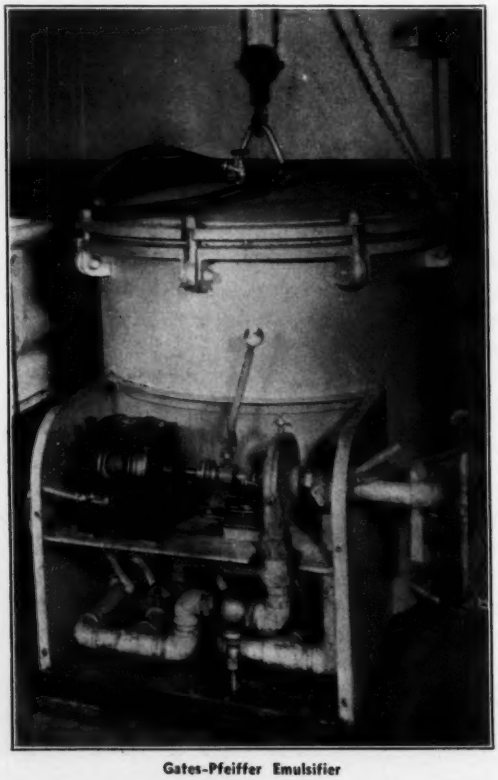
The Franklin Process Silk-Soaking Machine is of the circulation under pressure type. The silk is placed in a kier or tub between perforated plates, the top plate being attached to a cover which is clamped down on the kier. The soaking liquor is then introduced from the mixing tank into the kier by means of a centrifugal pump, circulation affected at a pressure of from 10 to 15 pounds, and the direction of flow, being changed at intervals, assures uniform soaking.

Another machine of the circulation type is the Gates-Pfeiffer Emulsifier. Here too a constant circulation of the



Franklin Process Silk Soaking Machine

soaking liquor is made possible by means of a centrifugal pump. A moderate pressure is built up within the air tight kier, which, coupled with a vacuum created suction, assures thorough penetration. The direction of flow is likewise changed at intervals. In the circulation type machine, the soaking is usually considered complete in from 1½ to 2 hours.



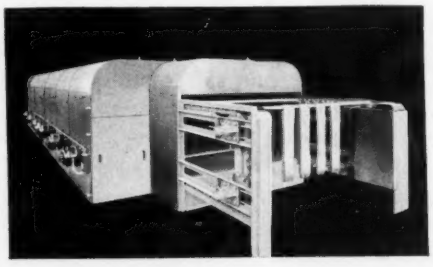
Gates-Pfeiffer Emulsifier

Although the introduction of machine soaking will not be pounced upon by the Technocrat, because it does not mean any material change in the labor involved, yet the advantages are readily apparent. The machines are built large enough to readily accommodate a bale of silk, but smaller quantities may be soaked at will, with equally good results.

The desired uniformity of lubrication and softening is attained not only in the lot being treated, but repeatedly in subsequent lots, thus alleviating to a considerable degree the bugbear encountered because of differences in the nature of the silk.

The period of time, ½ to 2 hours necessary for the operation, as compared to 5 to 12 hours in the still-bath soaking, allows greater flexibility.

A considerable saving, in the soaking material is affected, due to the fact that a higher "take-up" is possible in machine soaking than in tub soaking. The exact amount saved this way, depends somewhat on the type of machine, the materials used, and of course, on the particular requirements of successive processes. As in tub soaking the opening of the skeins before soaking and enclosing them in mesh bags, is preferable, altho possibly not as necessary.



C. G. Sargent's Sons Dryer

After soaking, the lot is extracted and may be dried by hanging the skeins in natural atmosphere for a period of from 5 to 24 hours, but here, also, we find that much speedier as well as more uniform results will be obtained by passing through dryers, developed for this purpose, whereby the drying can be accomplished in 20 to 30 minutes at a temperature of 160° to 180° F.

Because of the distinct advantages afforded in uniformity, and in speed of operation, together with the savings possible, these machines have been accepted by throwsters and are gradually replacing the still-bath or tub soaking method.

George A. Moran Now With Calco

George Moran, former chief chemist of the Pacific Print Works, Lawrence, Mass., has joined the Sales Technical Service Division of The Calco Chemical Company, Inc., replacing C. A. Funke, resigned.

In his new capacity, Mr. Moran will direct the Technical Service in the Printing and Dyeing of the Calco Fast Colors, and has established his headquarters at the main plant of the company at Bound Brook, New Jersey.

Modern Ideas on the Structure of Cellulose

By JOHN H. SKINKLE

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The situation in regard to our knowledge of cellulose has altered considerably in the last few years due to the development of X-ray technique and measurements, but due also to the recognition and almost universal adoption of a formula for cellulose which not only represents the facts we already know, but has also been used in predicting new facts as to cellulose chemistry. This article gives the data leading to the adoption of this formula and also points out correlations between it and the recorded properties of cellulose and its derivatives.

IF WE examine the literature on cellulose, we find a vast mass of material on certain aspects of cellulose chemistry and very scanty results on certain other aspects; moreover there is a certain amount of contradiction, usually of deductions and not of data, although in some cases the two have been hopelessly intermingled. The following facts, however, emerge as definitely proven or generally accepted:

1. Careful analysis of the most highly purified cellulose gives the empirical formula as $C_6H_{10}O_5$.

2. Hydrolysis of cellulose converts it almost completely to d-glucose ($C_6H_{12}O_6$).

3. Acetolysis (a combination of hydrolysis and acetylation) give approximately a 50% yield of cellobiose octa-acetate. If this is converted to cellobiose and further hydrolyzed, d-glucose is again obtained. Glucose forms a penta-acetate. Cellobiose may be shown to be formed by the condensation of two glucose molecules.

4. Each $C_6H_{10}O_5$ unit contains three hydroxyl groups which are capable of forming esters or ethers and which are therefore alcoholic in nature. The introduction of more than three acid radicals into a $C_6H_{10}O_5$ unit has never been performed without obvious decomposition.

5. The reducing power, as measured by the copper number, is very high in glucose and cellobiose, but is almost zero in pure cellulose; however, a cellulose with a copper number of zero has never been obtained.

6. Cellulose itself is insoluble in any solvent yet discovered. In every instance where solution of cellulose occurs, it may be proven definitely that a reaction occurs, or else there is strong, although not conclusive, evidence that reaction has taken place. When solutions in water of cellulose derivatives are examined, they are found to be emulsoidal sols and their molecular weights, while not directly obtainable, may be shown to be very high.

7. When cellulose is exposed to strong sodium hydroxide solutions, swelling and eventually solution occur and quite a large amount of heat is given off, much more than can be explained by adsorption, solution, partial valence or anything but chemical reaction. Various measurements have been made of the proportions of NaOH and $C_6H_{10}O_5$ in the resulting compound, the results being about evenly divided between 1 NaOH: 1 $C_6H_{10}O_5$ and 1 NaOH: 2 $C_6H_{10}O_5$ but in any case, not more than one NaOH to one $C_6H_{10}O_5$. Alcohols may react with bases in this way with the formation of alcoholates.

8. Upon degradation of the cellulose, by either acids or oxidizing agents, there results besides unchanged cellulose a material soluble in dilute NaOH with a yellow color, a high reducing power, and other characteristic properties of an aldehyde.

9. X-ray measurements show a recurring periodicity of 10.3 Angstrom units, which is the length of a cellobiose molecule and double the length (5.15 Angstrom units) of the glucose molecule. On swelling the cellulose, the length of this period remains constant but the breadth and width change. On the other hand, derivatives of cellulose having a periodicity of an odd multiple of 5.15 Angstrom units have been reported.

A formula for cellulose which will explain all the above facts may be derived in the following manner:

The formula of glucose and its two tautomeric forms is shown in Fig. 1. Two glucose molecules if condensed (with the elimination of water) would give cellobiose (Fig. 2). This is confirmed by the fact that glucose forms a penta-acetate while cellobiose, twice the size of glucose and yielding glucose on hydrolysis can form only the octa-acetate. If the cellobiose molecules be condensed in the same way, there would result a long chain of glucose or cellobiose anhydrides as indicated in Fig. 3. The end glucose residue, however, would be free to resume its other tautomeric form and give the reactions of an aldehyde, especially the power of reducing Fehling's solution. Since the chains are very long, however, this reducing power would be almost zero but never quite zero.

Hydrolysis of such a chain would break it at the oxygen bridges and form compounds similar to the original cellulose but of smaller chain length and therefore a greater number of ends, hence a greater reducing power. Eventually all the oxygen bridges would be broken and

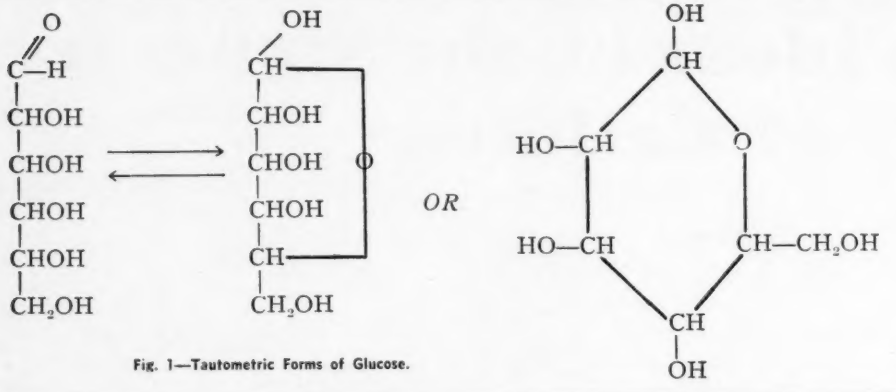

Fig. 1—Tautometric Forms of Glucose.

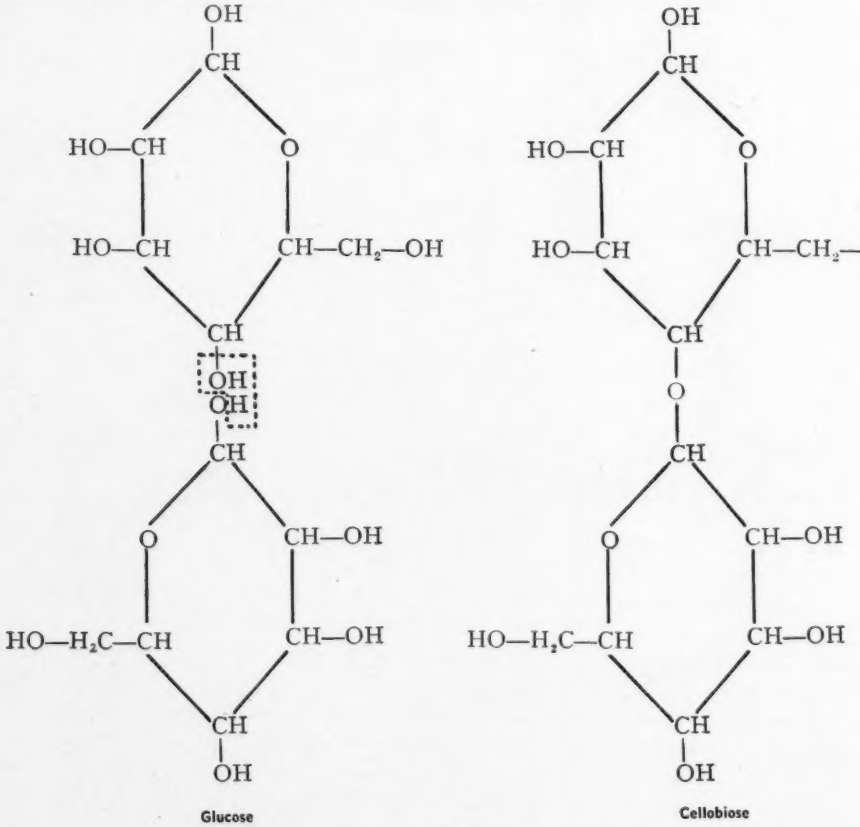

Fig. 2

glucose would result; more cautious hydrolysis would stop the process at the cellobiose stage. If in addition to hydrolysis, oxidation also takes place, the first result would be to oxidize the aldehyde groups of carboxyl groups with the formation of an organic acid (Fig. 4). In fact, one investigator has reported an "oxycellulose" of pronounced acidic properties and practically no reducing power.

Each unit in this chain has three hydroxyl groups of an alcoholic nature and hence capable of ester, ether, and alcoholate formation. If the methyl ether of cellulose is formed and hydrolyzed, tri-methyl glucose results, showing that in cellulose only three of the original five hydroxyls still exist; the other two, of course, go to make up the oxygen bridges. The formula represents one of the hydroxyl groups as present in a side chain. We would expect this group to react a little differently from the other two; and in fact, as has been mentioned, only one hydroxyl reacts with NaOH. Experiments on cellulose dissolved in liquid ammonia have shown that one hydrogen is easily replaced by sodium and two others with more difficulty, this also indicates that one hydroxyl group is somehow different from the other two.

The extreme insolubility of the cellulose and the high viscosities of its derivatives in solution indicates a high molecular weight. The fact that swelling does not change the X-ray period lengthwise while it does change the width and breadth shows that the basic units are held strongly by primary valences lengthwise of the chain while the lateral forces are much weaker and probably consist of secondary valence forces.

Hydrate cellulose is met with in the industry as rayon or as mercerized cotton. In spite of its name, hydrate cellulose has no more water chemically combined with it than has ordinary cellulose; it has been defined as "any alteration product of cellulose which shows no change in copper number over the original material." Hydrate cellulose consists of reprecipitated cellulose which has been dissolved in, or swollen by: esterification followed by solution, wet beating (paper), strong alkalies, strong acids, some neutral salt solutions, ammoniacal copper oxide.

(Continued on page 295)

PROCEEDINGS OF THE
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APRIL 24, 1933

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Raw Silk and Throwing*

By PENRHYN WILSON
R. K. Laros Silk Co.

THE origin of silk is obscured by the veil of antiquity to such an extent that we cannot say with a great deal of assurance how or when silk was actually discovered. The most commonly accepted legend credits the discovery to Hsi Ling Shi, child bride of Huang Ti, Third Emperor of China, who ruled some four thousand years ago. She, so the story goes, not only discovered the secret of the silk worm but learned to unwind the silken fibers from the cocoons themselves and ingeniously devised a crude loom upon which she wove these silken strands into gorgeous fabrics and robes, for which even to this day the Chinese are celebrated. She not only accomplished these things for herself but she taught the secrets and lessons she had learned to her countrywomen and thus the silk industry had its birth. Whether the story is true or not, we cannot say, but Hsi Ling Shi is worshipped by her descendants today as the Goddess of the silk worm.

For more than two thousand years the secret of silk remained inviolate with the Chinese. For more than twenty centuries of time, she was the sole source of supply for the then civilized world. The penalty for disclosure was death but like all secrets, it eventually became known and by some devious path the silk worm found its way beyond the great wall of China into other lands.

It is thought that Japan commenced the production of silk about the year 600 A.D. but despite this comparatively late start, she has far outstripped her sister nation in the production and exportation of raw silk and is today the acknowledged leader of the silk exporting countries of the world.

For instance, in the year 1932, ninety percent of all the silk consumed by mills in the United States originated

*Presented at Meeting, Philadelphia Section, March 24.

in Japan. The remaining 10% was exported from China, Italy, France and one or two lesser sources of supply.

There might be an appropriate lesson for us during these difficult days in the fact that after four thousand years, China is still a factor in the silk industry. During this long period of time China had been subjected to perhaps more than her share of all the trials and tribulations that might conceivably confront a nation. External as well as internal strife, political confusion and economic chaos have been her portion and yet she is still doing business, pretty much in the same old way.

Primarily, silk is a product of agriculture. Silk worms are hatched in incubators from selected eggs supplied by the government to the farmers. They are tenderly cared for and fed on finely chopped mulberry leaves for a period of approximately one month, at which time the silk worm has attained the age where it justifies its existence by the spinning of a cocoon—a process consuming about three days' time.

A certain, carefully selected percentage of the crop is set aside and the worm is allowed to complete its life cycle by becoming a moth and piercing the cocoon so that succeeding generations can be provided for.

The balance of the crop is subjected to heat sufficiently high to kill the chrysalis within the cocoon and sold to the owners of the filatures or reeling plants in which the cocoon filaments are reeled into thread.

A cocoon filament is approximately 2½ deniers in size on the average. A denier is a measurement of weight and is equivalent to the weight of a 450 meter skein weighing five centigrams. The thread commonly used in this country by hosiery manufacturers is made by twisting together two or more ends of raw silk of 13/15 denier, while the weaving trade employs largely 20/22 denier. It is necessary, therefore, to simultaneously reel fibers from five or more cocoons so that a thread of commercial size can be obtained. This is the function of the reeling plant or filature.

In considering the extremely light weight, compared with the yardage of pure silk, it is possible to evolve some rather interesting "Ripleyisms." For instance—a pound of 13/15 denier silk will reach from New York to Philadelphia and return. The yardage contained in a single bale of Japan silk will gird the earth at the equator and one pound of cocoon fiber if reeled into a continuous thread would reach from New York to Chicago.

Mankind has always honored the bee for its industrious habits but the humble silk worm has well deserved claims for the position of runner-up.

The yardage of silk on a single cocoon varies from 700 to 1,000 yards and consequently, after reeling the cocoon filament into the form of a small skein, it is necessary to re-reel these skeins so as to secure a continuous skein of convenient size—50,000 yards in length. After this operation, the skeins are made up into cubical packages called a book, weighing approximately 4½ pounds. Twenty-eight books constitute a bale, weighing on the average of 132 pounds. The silk is now ready for export and after being graded for quality, is transported across the Pacific Ocean to Pacific Coast Ports and thence overland to New York City. More than half of the crop during recent years, however, is shipped through the Panama Canal on its way to New York at a considerable saving in transportation costs.

After passing through the hands of the importers, it reaches the throwing plants of the country, where it is converted into threads of commercial size for the loom or knitting machine. The word "throwing" comes from the Saxon word "throwan" and means to twist.

Silk in its raw state contains approximately 18½% of sericin or gum exuded by the silk worm during the spinning process and forms a cohesive bond which holds the individual filaments together. After carefully testing the silk for quality, the throwster soaks the raw material in a tepid solution of soap, oil and water or simply oil and water to soften these natural gums and render the silk pliable for throwing as well as the subsequent operations of knitting and weaving.

The silk is wound on to bobbins, plyed and twisted in accordance with the owners specifications and is finally placed in the form of a conical package for convenience in knitting.

At the present time, practically all hosiery for women is made of yarn of from 2 to 12 ends twisted together 5 to 25 or more turns to the inch. There is a small production of freak stockings made of the single end of 13/15 denier silk but the quantity is unimportant and will probably remain so. Sheer stockings of dull luster enjoy the greatest favor at the moment and are made of 2 to 4 thread silk. Semi-service and service weight of 5 to 7 thread are probably next in popularity, while the heavy weights are diminishing in volume annually.

It is frankly almost impossible to secure silk sufficiently high in quality today to produce 2 and 3 thread stockings in satisfactory quantities without running into excessive waste and seconds. Reeling methods on the higher grade silks have been improved in Japan in recent years, with the adoption of stop motion devices on the reeling spindles and silk so reeled is known as "machine" reeled silk. Considerable strides have been made in the testing of raw silk so as to secure greater accuracy in grading. Much has been accomplished in the way of eliminating the human equation in arriving at the quality of raw silk and the grading of higher qualities is now determined largely by mechanical means. Much still remains to be accomplished along these lines, however, before we can feel with assurance that results shown by the test will be confirmed when the silk has been knitted into hosiery.

The chief problem of the hosiery manufacturer lies in the necessity of securing silk as nearly uniform in size as possible. The lack of such uniformity creates unsightly, horizontal bands in the finished hosiery and is the cause of the greater portion of seconds produced in manufacturing sheer fabrics. Pure silk, not being a machine made product but spun by a worm, who selfishly manufactures only with his own specifications in mind, is naturally uneven. As a matter of fact, a single cocoon fiber varies from 1½ to 2½ deniers in size within its own length, so you can readily understand the difficulty of producing uniformity under the circumstances, particularly when the test skeins representing any lot of silk form such an extremely small portion of the entire yardage involved.

Perhaps the hosiery manufacturer is overlooking an opportunity in failing to capitalize on the inherent unevenness present in all raw silk. It is a distinguishing characteristic and practically guarantees that his product is constructed of pure silk, at least until some enterprising rayon manufacturer conceives the idea of deliberately creating unevenness, so that the resulting product will resemble silk even more closely.

Discussion

Mr. Charles Thomas: I noticed a statement on that film saying that on those winders the threads were inspected when thrown. I would like to know what the inspection was.

Mr. P. Wilson: Only that there are slub catchers at each bobbin and I suppose they do not always, as the manufacturers will testify, take out all the raw silk imperfections that might be present in the original skein, but the setting is at three thousandths of an inch, and our intentions are good. That is the inspection or cleaning that it gets in the original winding process.

Mr. Bruce: I would like to ask Mr. Wilson if he is familiar with the soaking operation, and what the general opinion of their plant is with regard to the use of mineral oils in soaking?

Mr. Wilson: Well, that is a subject that has been pretty well discussed ever since I have been in the silk business. Personally, I question very much whether mineral oil has any very disadvantageous effect on dyeing, although I don't think I have ever seen a dyer yet who did not complain of mineral oil in the silk. We do not use mineral oil for soaking purposes except on rayon. For pure silk we have always steered clear of it, largely because the dyers are very much opposed to it. From a technical point of view I do not believe I am qualified to give you a very satisfactory opinion on the subject. I see only the sales end of our product, but I do come into contact with dyers from time to time. The knowledge that we do not use mineral oil in the soaking process is often a great help when I am talking with an irate buyer about "nigger balls." Personally, we stay away from it except on rayon. I think that is a general practice.

EIGHTY-SEVENTH COUNCIL MEETING

THE Eighty-seventh Council Meeting of the American Association of Textile Chemists and Colorists was held at The Chemists' Club, New York, N. Y., Jan. 27, 1933 at 2:00 P. M.

The following were present:—

President: R. E. Rose.

Vice-President: Wm. H. Cady.

Treasurer: Wm. R. Moorhouse.

Councilors: Wm. D. Appel, H. M. Chase, Carl Z. Draves, Walter M. Scott.

Councilors ex-officio: Hans Meyer, representing Chairman, N. Y. Section; Donald H. Powers, representing Chairman, Phila. Section; Prof. L. A. Olney, Chairman, Research Committee.

Secretary: A. Newton Graves.

The report of the last meeting was read and approved.

The Secretary's balance sheet was read as follows and approved:—

Secretary's Balance Sheet—Jan. 24, 1933

Cash on hand December 2, 1932		$ 854.38
Receipts Dec. 2, to Jan. 24, Incl.:		
Applications	20 @ $5.00	100.00
Applications	8 @ $2.50	20.00
Arrears	1 @ $2.50	2.50
Dues (1933)	326 @ $5.00	1,630.00
Dues (1933)	2 @ $2.50	5.00
Dues (1933)	1 @ $4.15	4.15
Dues (1933)	1 @ $4.10	4.10
Dues (1933)	1 @ $4.34	4.34
Dues (1933) Corporate		200.00
Dues Life Member		100.00
Reporters (Howes)		3.50
Royalty on Launderometers		33.00
Yearbooks	7 @ $3.00	21.00
Light Fastness Report		1.08
Pied. Section (for bill rendered)		25.25
Analytical Methods	16 @ $ .75	12.00
Analytical Methods & Postage	1 @ $ .80	.80
Analytical Methods & Postage	1 @ $1.00	1.00
Worsted Tubing 20 yds. @ $ .20 per yd.		4.00
		$3,026.10
Disbursements:		
To Treasurer, Dec. 27, General Fund		$1,142.00
To Treasurer, Dec. 27, Research Fund		358.00
To Treasurer, Jan. 24, General Fund		969.92
To Treasurer, Jan. 24, Research Fund		30.08
Government Tax on checks		.08
Cash on hand, Nat'l Bank of Commerce & Trust Co.		481.02
Cash on hand		45.00
		$3,026.10

The Treasurer's report was read as follows and approved:—

Treasurer's Report—January 26, 1933

GENERAL FUND

Cash on hand—November 30, 1932	$5,226.08
Receipts—November 30, 1932 to January 26, 1933	2,785.92
	$8,012.00
Expenditures—November 30, 1932 to January 26, 1933	465.19
	$7,546.81

RESEARCH FUND

Cash on hand—November 30, 1932	$1,771.52
Receipts—November 30, 1932 to January 26, 1933	2,164.08
	$3,935.60
Expenditures—November 30, 1932 to January 26, 1933	856.73
	$3,078.87

BANK BALANCE

General Fund	$7,546.81
Research Fund	3,078.87
	$10,625.68
First National Bank—Checking Account	$4,249.48
First National Bank—Savings Account	6,376.20
	$10,625.68

The following were elected to membership as of thirty days after the publication of their names provided no objections to any are received by the Secretary:—

Active:

Alkus, William—1531 Nedro Ave., Philadelphia, Pa. Chemist, Charles W. Berg Laboratories, 1827 N. Fifth St.

Bick, Hans C.—P. O. Box 565, Reading, Pa. President, Hans C. Bick, Inc.

Cadgene, Ernest—Englewood, N. J. Chemist and Manufacturer, Lyons Piece Dye Works, Paterson, N. J.

Fabian, Paul F.—68 Chapel St., Putnam, Conn. Superintendent Colorist, Uncas Finishing Corp., Mechanicsville, Conn.

Gates, Thayer P.—824 Main St., Danville, Va. Technical Expert, Riverside & Dan River Cotton Mills.

Horne, Hugh J.—502 Washington St., Roanoke Rapids, N. C. Dyer and Chemist, Roanoke Mills Co.

Hug, Gustave—365 East 39th St., Paterson, N. J. Chemist, Hydro, Inc., 100 East 5th St.

Johnson, Albert C.—44 Church St., North Andover, Mass. Second hand (Dyeing), Ayer Mills, Lawrence, Mass.

Krassner, Frederick—1850 48th St., Brooklyn, N. Y. Chief Chemist, Naval Supply Depot, 29th St. and 3rd Ave.

Light, B. Carl—350 North Sixth St., Reading, Pa. Chemist, Penn Maid Hosiery Co.

MacFarland, L. B.—2637 Rosemont Ave., Chicago, Ill. Salesman-Demonstrator, American Aniline Products, Inc., 820 S. Clinton St.

McCusker, John H.—650 Cronston St., Providence, R. I. Overseer of Bleaching, Dyeing and Finishing, Rhode Island Lace Works, Inc., West Barrington, R. I.

Peever, Alfred—18 Riverside St., Lewiston, Me. Chemist, Cowan Woolen Co.

Smith, Irwin J.—20 Homestead Ave., Albany, N. Y. Vice-President, Surpass Chemical Co., Inc., 1254 Broadway, Albany, N. Y.

Steiner, Edgar N.—35 East 27th St., New York, N. Y. Chemist, American Aniline Products, Inc., 66 University Place.

Stubbings, Frank A.—3019 88th St., Jackson Heights, L. I., N. Y. Dyer, Pilgrim Piece Dye Works, 1 Nassau Ave., Brooklyn, N. Y.

Suttenfield, T. W.—902 S. Main St., High Point, N. C. Superintendent, Cloverdale Dye Works, Inc.

Junior:

Clapp, C. V.—316 "E" St., North Wilkesboro, N. C. Textile Chemist, Wilkes Hosiery Mills.

Ecker, George F., 3rd—312 Wellington Road, Jenkintown, Pa. Chemist, 2018 East Willard St., Philadelphia, Pa.

Fanale, James J.—462 North Main St., Lodi, N. J. Textile Chemist, United Piece Dye Works.

Student:

Bliven, H. S.—North Carolina State College, Raleigh, N. C. Student.

Dorn, G. B.—R. F. D. No. 4, Greenwood, S. C. Student, Clemson College, Clemson College, S. C.

Fisher, A. G., Jr.—1801 Heyward St., Columbia, S. C. Student, Clemson College, Clemson College, S. C.

Hundley, R. H., Jr.—Monroe St., Leaksville, N. C. Student, North Carolina State College, Raleigh, N. C.

Kennemur, D. H., Jr.—Box 96, Liberty, S. C. Student, Clemson College, Clemson College, S. C.

Phillips, C. R.—1445 19th St., Columbus, Ga. Student, Clemson College, Clemson College, S. C.

Thomson, W. B.—134 North Main St., Abbeville, S. C. Student, Clemson College, Clemson College, S. C.

Torrence, Daniel A., Jr.—110 North Jefferson St., Petersburg, Va. Student, North Carolina State College, Raleigh, N. C.

(Continued on page (192) 288)

Proceedings of the American Association of Textile Chemists and Colorists

The Combination of Silk and Wool With Positive and Negative Ions*

By MILTON HARRIS[1]

QUANTITATIVE determinations of the combination of proteins with ions are made by electrometric methods. Qualitative determinations are made by employing salts containing colored ions or ions which may form colored compounds on treatment with the proper reagents. Both methods have been used for the determination of the isoelectric point. It is the purpose of this paper to show the possibilities and limitations of such methods.

Wool, with an isoelectric point at pH 3.4, combines with negative ferrocyanide ion in solutions ranging in pH up to about 5.0 and with positive nickel ion in solutions ranging in pH down to about 2.0. Similarly silk, with an isoelectric point of pH 2.5, combines with ferrocyanide ion up to about pH 4.0 and with nickel ion down to about pH 1.8. Evidently these amphoteric proteins combine with both positive and negative ions over a certain range on both sides of the isoelectric point. The extent of this "isoelectric region" depends upon the ions employed as well as upon the protein. The limiting values obtained for the pH at which ions combine with a protein do not necessarily represent the isoelectric point of the protein.

II. Theoretical

A colloidal (or other) particle is at its isoelectric point when the particle is electrically neutral with respect to its surrounding medium. For an amphoteric substance at its isoelectric point, the concentration of the anions is equal to that of the cations. That the sum of the anion and cation concentration is a minimum may be proved as follows:[2, 3]. Consider an amphoteric electrolyte of the type HROH. The law of mass action gives the following relationship:

$$\frac{[HR^+]\,[OH^-]}{[HROH]} = K_b \quad (1)$$

$$\frac{[ROH^-]\,[H^+]}{[HROH]} = K_a \quad (2)$$

At the isoelectric point $[HR^+] = [ROH^-]$ therefore

$$\frac{K_b\,[HROH]}{[OH^-]} = K_a \frac{[HROH]}{[H^+]} \quad (3)$$

Since $K_w = [H^+]\,[OH^-]$ then (3) reduces to

$$[H^+] = \sqrt{\frac{K_a}{K_b}} \times K_w \quad (4)$$

From equation (1) and (2) we may write

$$[HR^+] = [ROH^-] = K_b \frac{[HROH]\ [H^+]}{K_w} + K_a \frac{[HROH]}{[H^+]} \quad (5)$$

Let $X = [HR^+] + [ROH^-]$ For X to be a minimum, $\frac{dX}{d\,[H^+]}$ must equal o. This condition is fulfilled when $[H^+] = \sqrt{\frac{K_a}{K_b}} \times K_w$ which is the value of $[H^+]$ at the isoelectric point given in equation (4). Therefore X, the sum of the anion and cation concentrations, is a minimum at the isoelectric point.

That the ionization at this point is not zero is clearly shown in the dissociation curves of p-amino benzoic acid[2] (Figure I). They intersect at pH 3.77 which is the isoelectric point of this ampholyte. It is apparent from the curves that p-amino benzoic acid combines with positive ions on the acid side of the isoelectric point to about pH 2.7; similarly it combines with negative ions on the alkaline side to about pH 4.9. These two points are the approximate limits of what may be called its isoelectric range.

If curves A and B intersected at zero per cent dissociation, the point of intersection would represent the isoelectric point. Moreover, if the two curves are symmetrical the isoelectric point will be the mean of the two limits. Such measurements might therefore be useful for defining approximately the isoelectric point. The suitability of such methods will depend largely on the sensitivity with which the limits of combination of the ions can be determined. The principle is illustrated by the data given on the next page which show that the mean of the two limits for wool is 3.5 while the isoelectric point determined by migration is 3.4. The agreement for silk, for which the values are 2.9 and 2.5 respectively, is not so good, probably because of the difficulty noted in detecting the limits of combination.

III. Review of Previous Work

Northrop and Kunitz[4] have contributed considerable

[1]Research Associate of the American Association of Textile Chemists and Colorists.

[2]W. M. Clark, "The Determination of Hydrogen Ions," p. 32, Williams and Wilkins Company (1928).

[3]L. Michaelis, "Hydrogen Ion Concentration," pp. 62-65, Williams and Wilkins Company (1926).

[4]J. H. Northrop and M. Kunitz. "Combination of Salts and Proteins." J. General Physiology *7*, p. 25 (1924); *9*, p. 351 (1926); *11*, p. 481 (1928).

*Published in connection with Research Project 5-33, which has been made possible through an allocation to the American Association of Textile Chemists and Colorists by the Textile Foundation.

data on the combination of gelatin with cations and anions on both sides of the isoelectric point. They used concentration cells and a method based on the measurement of membrane potentials for those ions for which no electrode was available. They found that gelatin combines appreciably with copper in acid solutions to pH 2 and with calcium to pH 2.5, values which are considerably on the acid side of the isoelectric point of pH 4.7.

Pauli and Schön[5] measured the combination of undenatured egg albumin with zinc chloride. Chloride ion was found to be in a bound condition up to about pH 6. This justified Pauli's contention that negatively charged protein was capable of combining with the anion of the salt.

Carroll and Hubbard[6] found that the amount of silver ion combined with gelatin increases with increasing pH but does not fall to zero on the acid side of the isoelectric point.

Loeb[7], Speakman[8] and Denham and Brash[9] have reported values for the isoelectric points of gelatin, wool, and silk, respectively, obtained qualitatively from the reactions of salts with these substances. The value which Loeb obtained for the isoelectric point of gelatin is in good agreement with values obtained by other workers employing various methods. The values which Speakman and Denham and Brash obtained for the isoelectric points of wool and silk are not in good agreement with those obtained by other workers[10].

Speakman treated samples of wool with standard potassium ferrocyanide solutions of known pH. After 24 hours the wool was removed and carefully washed to remove uncombined ferrocyanide and then immersed in ferric chloride solution to form the blue ferriferrocyanide. By this procedure he found that when the pH was high no combination with the ferrocyanide ion occurred; at pH 4.8 combination began and as the pH decreased the amount of ferrocyanide ion absorbed by the wool increased. He concluded from this that the isoelectric point of wool was in the neighborhood of pH 4.8. In his paper only the combination with negative ferrocyanide ion was reported, no experiments with positive ions being mentioned.

Denham and Brash treated samples of silk with copper acetate, silver nitrate and potassium chromate. Using copper acetate, they estimated the isoelectric point of China silk to be at pH 3.9 but with Tussah silk they found it to be between pH 3.0 and 3.7. Using silver nitrate

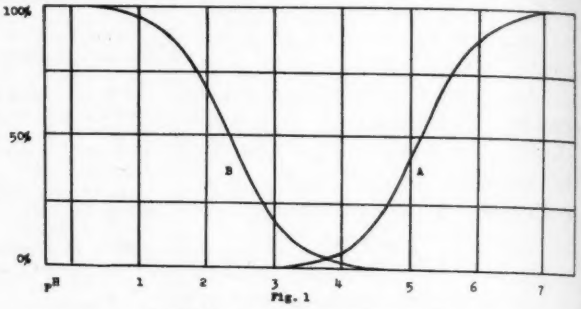

Fig. 1

Dissociation Curves of p-Amino-Benzoic Acid

they found the results to be "less definite but indicated that the isoelectric point of fibroin lies at pH 4 or at a less pH value." In experiments with potassium chromate they found that the chromate ion was not held by the silk at pH 3.7 and above. They concluded that "the determination of the exact position of the isoelectric point in the ways described is therefore not quite certain apart from the question of an isoelectric range or of more than one isoelectric point," but concluded that that point lies between pH 3.6 and pH 4.0.

IV. Experimental

Samples of wool and boiled-off silk were purified by successive extractions with alcohol and ether until no appreciable residue was obtained on evaporation of the solvent.

The wool samples were treated with a one per cent potassium ferrocyanide solution in a pH range from 2 to 7. After 24 hours the wool was removed and each sample washed in a buffer solution of the same pH as the ferrocyanide solution in which it had been soaked. The washing was continued until no ferrocyanide could be detected in the sample treated at pH 7. It was assumed that all ferrocyanide mechanically held by the wool would wash out at the same rate regardless of the pH and only that chemically combined would be retained. The samples were immersed in a one per cent ferric chloride solution for one hour after which they were rinsed and dried. The samples treated above pH 5 showed no color; a light blue appeared at pH 5 and increased in depth as the pH decreased.

(Continued on page (188) 284-

[5]W. Pauli and Schön, "Untersuchungen an elektrolytfreien, wasserloslichen Proteinen." Biochem Zeit, *153*, pp. 253-284 (1924).

[6]B. H. Carroll and D. Hubbard. "The Photographic Emulsion—The Silver Ion-Gelatin Equilibrium." Bur. Stand. Jour. of Research *7*, pp. 811-825 (1931).

[7]Jacques Loeb, "Proteins and the Theory of Colloidal Behavior," p. 28. McGraw-Hill Company.

[8]J. B. Speakman, "The Behavior of Wool as an Amphoteric Colloid." J. Soc. Dyers and Colourists *41*, pp. 172-179, (1925).

[9]W. Denham and W. Brash, "The Isoelectric Point of Silk Fibroin." J. Text. Inst. *18*, pp. T520-525 (1927).

[10]L. Meunier and G. Rey. "Sur les Proprietes de la laine," J. Intern. Soc. Leather Trades' Chemists *11*, p. 508 (1927).

H. R. Marston—"The Chemical Composition of Wool," Australia, Council Sci. and Ind. Res. Bull. No. *38*, 36 pp. (1928.)

M. Harris, "The Isoelectric Point of Wool," Bur. of Stand. J. of Res. *8*, pp. 779-786 (1932).

T. G. Hawley, and T. B. Johnson, "The Isoelectric Point of Silk," Ind. & Eng. Chem. *22*, pp. 297-299 (1930).

M. Harris and T. B. Johnson, "Study of the Fibroin from Silk in the Isoelectric Region," Ind. & Eng. Chem. *22*, p. 539 (1930).

L. Meunier and G. Rey, "Determination du point isoelectrique de la laine et de la soie." Compt. Rend. *184*, p. 285 (1927).

M. Harris, "The Isoelectric Point of Silk," Bur. of Stand. J. of Res. *9*, pp. 557-560 (1932).

Proceedings of the American Association of Textile Chemists and Colorists

Fastness to Washing of Dyed Wool*†

By BERTIL A. RYBERG

Research Associate of the American Association of Textile Chemists and Colorists

THE Sub-Committee on Fastness Tests for Dyed Wool of the American Association of Textile Chemists and Colorists, namely, Hugh Christison, Chairman, Roland Derby, Harold Leitch, Claxton Monro and Alex. Morrison, in the course of their activities, had selected the following dyeings as standards representing the minimum fastness to washing or launderings, of dyed woolen material, for each class of fastness:

Class 1

2% Erio Chrome Azurole BX
(Colour Index 720)

Class 2

2% Brilliant Milling Blue B
(No Colour Index No.; General Dyestuff Corporation)

Class 3

3% Patent Blue A
(Colour Index 714)

Class 4

3% Patent Blue V
(Colour Index 712)

The dyeing methods for the above standards will be found in the 1931 Year Book.

A considerable number of dyeings were prepared and tested according to the method and specifications adopted by the Sub-Committee, given in the Year Book of the A.A.T.C.C. for testing the fastness to washing or laundering of dyed woolen material. The results of this work, carried on by Wm. C. Smith, a research associate of the A.A.T.C.C. under the direction of the sub-committee led to the selection and adoption of the above standards, representing the minimum fastness for each class.

These standards were first published in the Year Book for 1930, which was distributed in the spring of 1931. Within a year from the date of publication of these standards, criticisms were received from various dye manufacturers and mill men, concerning the standards for classes 3 and 4, namely

Class 3—3% Patent Blue *A*
Class 4—3% Patent Blue *V*

The contention was, that under identical treatment and physical conditions, tests *three* and *four* of the fastness tests to washing of dyed woolen material, Patent Blue *A*, class *3* does not lose nearly as much in depth of shade or actual color loss, as does Patent Blue *V*, class *4*, which from the viewpoint of relative color loss is satisfactory; *but*, when the staining of other adjacent fibers (white silk, wool, cotton, viscose rayon, acetate rayon), is of primary importance, the Patent Blue *A*, class *3*, stains considerably more than does the Patent Blue *V*, class *4*, which is contrary to the ideas of the relative requirements for fastness of classes *3* and *4*. The Sub-Committee, realizing this discrepancy, has had further investigation made on the matter, and is pleased to announce the selection of two new standards for classes *3* and *4*, which they believe will satisfy the general requirements for these two classes, replacing those so severely criticized. This report gives a description of the work done and results obtained.

A thorough investigation of the literature relating to the fastness to washing of dyestuffs on wool was made. This investigation covered the Colour Index, dye color cards from various manufacturers of dyestuffs, the files on dyestuffs tested for fastness to washing on wool at the Lowell Textile Institute, and files of the same material at the Arlington Mills. In addition to this, the opinions of the members of the Sub-Committee, regarding various dyestuffs and dyeings, which they know from actual experience, would come within certain limits of fastness, were recorded. This investigation resulted in the testing of the following list of forty-five dyestuffs in various percentages in the hope of finding two dyeings which would fill the requirements set for classes *3* and *4*.

List of Dyeings

	C.I.	
Patent Blue A	714	Acid Dyed
Patent Blue V	712	Acid Dyed
Alphazurine G	...	Acid Dyed
Alphazurine FG	671	Acid Dyed
Alphazurine B conc.	...	Acid Dyed
Alizarine Astrole B	1075	Acid Dyed
Alizarine Astrole B	1075	Top-chromed
Alizarine Sky Blue B	1088	Top-chromed

*This investigation has been made possible through the Textile Foundation.

†Acknowledgment is made of the use of the Lowell Textile Institute Laboratories where the experimental work was conducted.

Alizarine Sky Blue B.....	1088	Acid Dyed
Alizarine Irisole R.....	...	Acid Dyed
Azo Wool Violet 2G.....	...	Acid Dyed
Pontacyl Blue R.....	208	
Pontacyl Blue RE	208	Acid Dyed
Brilliant Milling Blue B.....	...	Acid Dyed
Pontacyl Sulphon Blue 5R conc..	...	Top-chromed
Azo Rubine R.....	179	Top-chromed
Indigotine conc.	1180	Acid Dyed
Anthraquinone Blue SR Ex.....	...	Acid Dyed
Alizarine Saphirol SE.....	1053	Acid Dyed
Alizarine Saphirol B.....	1054	Acid Dyed
Cyananthrol R	1076	Acid Dyed
Fast Acid Violet 10B.....	...	Acid Dyed
Xylene Milling Blue BL.....	...	Acid Dyed
Xylene Milling Blue BL.....	...	Top-chromed
Wool Violet 4BN.....	698	Acid Dyed
Acid Fast Violet BG.....	699	Acid Dyed
Fast Wool Blue B.....	209	Acid Dyed
Violamine R	758	Acid Dyed
Ethonic Fast Violet 2RLN.....	...	Acid Dyed
Anthraquinone Violet R.....	1080	Acid Dyed
Superchrome Violet B.....	169	Top-chromed
Pontacyl Violet 4BL.....	...	Acid Dyed
Pontacyl Violet 6BN.....	...	Acid Dyed
Newport Acid Blue SR.....	...	Acid Dyed
Fast Acid Violet RM Ex.....	...	Acid Dyed
Alizarine Supra Blue A3R.....	...	Acid Dyed
Soluble Blue T.....	...	Acid Dyed
Cyanol FF	...	Acid Dyed
Brilliant Acid Blue FF.....	...	Acid Dyed
Wool Blue N Ex.....	...	Acid Dyed
Acid Cyanine BF.....	...	Acid Dyed
Alizarine Blue WSA.....	...	Acid Dyed
Alizarine Direct Blue AGG.....	...	Acid Dyed
Alizarine Supra Blue A.....	...	Acid Dyed
Alizarine Supra Blue SES.....	...	Acid Dyed
Alizarine Sky Blue G.....	...	Acid Dyed
Alizarine Uranol BB.....	...	Acid Dyed
Alizarine Uranol R.....	...	Acid Dyed

The dyeings listed above were given the following tests, according to the method and specifications adopted by the Sub-Committee, for testing the fastness to washing of dyed woolen materials, as given in the Year Book of the A.A.T.C.C.

Test 2—Two hours with alkaline soap solution
Test 3—Two hours with neutral soap solution
Test 4—Thirty minutes with neutral soap solution

The results of these tests were exhibited at meetings of the Sub-Committee on Fastness Tests for Dyed Wool, from time to time as the work progressed. There was some hesitancy about selecting the standards without thorough investigation. It was thought best to consult the various dyestuff manufacturers regarding possible dyestuffs or dyeings, which they might suggest as possible standards for classes 3 and 4.

Letters were sent to the larger dyestuff manufacturers explaining the situation and soliciting their cooperation, and any suggestions they might have to offer regarding the matter. Several of the dyestuff manufacturers suggested one or more dyestuffs which in their opinion, might possibly fill the requirements set for the particular classes in question. Others stated that in their opinion, enough work had been done on the matter, and that it should be possible to select standards from the dyeings already tested.

Samples of the dyestuffs, suggested by the manufacturers, were obtained and tested in the same way as the others. The following is a list of those dyeings:

3%	Calcocid Milling Blue NF.....	Acid Dyed
2%	Brilliant Wool Blue G ex.....	Acid Dyed
2%	Brilliant Wool Blue FFR.....	Acid Dyed
2%	Brilliant Wool Blue FFB.....	Acid Dyed
2%	Erio Cyanine	Acid Dyed
2%	Erio Fast Cyanine S conc.....	Acid Dyed
2%	Erio Fast Pure Blue ex.....	Acid Dyed
2%	Acid Brilliant Blue BR conc...	Acid Dyed

Samples of all the dyestuffs and dyeings tested were exhibited together at a meeting of the Sub-Committee on Fastness Tests for Dyed Wool. After considerable discussion, examination and comparison of samples, the Sub-Committee came to an agreement that the dyestuff or dyeing most suitable, as regards both loss in color and staining, for class *4* is

1% Alizarine Sky Blue B
(Colour Index 1088)

Dyeing Method

The wool is wet out hot and entered in a 50 times bath at 120° F., containing the dye and 20% Glauber's salt crystals, 5% acetic acid (28%). The temperature is raised to boiling in 15 minutes and boiling is continued for 45 minutes.

1% sulfuric acid (conc.) is added and boiling is continued for 30 minutes. The wool is rinsed, extracted and dried.

It shows a progressive staining and loss in color under tests 4, 3 and 2 which is very satisfactory.

The most difficult problem was the selection of a dyestuff or dyeing for class 3. It was hoped that a dyeing could be found which would show the same type of progressive staining and loss of color under tests 4, 3 and 2, as does Alizarine Sky Blue B, but of course not nearly as pronounced.

The difficulty seems to occur in relation to test 2, the alkaline soap solution test. Several dyeings showed progressive staining and loss of color in tests 3 and 4, which fits the requirements set, but, under test 2, the staining is slight being much less than in test 3, and the loss in

color is much greater. Practically all the dyes tested show this behavior, with the exception of *Alizarine Sky Blue B*, which was selected as a standard for class 4, because it *does* show progressive staining as well as loss of color in tests 4, 3 and 2.

An examination of all the dyeings tested failed to produce one which shows a stain relative to the loss in shade or color depth in test 2 with the exception of Alizarine Sky Blue B. The suggestions offered by the dyestuff manufacturers seemed to fall into the same category. The Sub-Committee therefore, selected a dyeing which comes the nearest to filling the requirements set for class 3.

This dyeing is

1% Patent Blue A
(Colour Index 714)

Dyeing method same as for Alizarine Sky Blue B

Samples of the following dyes or dyeings,

Class 2 1% Brilliant Milling Blue B
2% Brilliant Milling Blue B
Class 3 1% Patent Blue A
Class 4 1% Alizarine Sky Blue B

were given washing fastness tests 4, 3 and 2 and the results compared. The Sub-Committee then decided that for uniformity of depth of color and staining that Brilliant Milling Blue B class 2, should be a 1% dyeing as a standard.

Tested samples of the four standards were compared side by side, and the gradation in color loss and staining was uniform throughout the entire range of fastness classification.

The Sub-Committee therefore has selected the following dyeings as standards, representing the minimum fastness for each class.

Class 1

2% Erio Chrome Azurole BX
(Colour Index 720)

Dyeing Method

The wool is wet out hot and entered in a 50 times bath at 120°F., containing the dye and 20% Glauber's salt crystals, 5% acetic acid (28%). The temperature is raised to boiling in 15 minutes and boiling is continued for 1 hour.

1.5% sodium bichromate is added and boiling is continued for 45 minutes. The wool is rinsed, extracted and dried.

Class 2

1% Brilliant Milling Blue B
(No Color Index No. General Dyestuff Corp.)

Dyeing Method

The wool is wet out hot and entered in a 50 times bath at 120°F., containing the dye and 20% Glauber's salt crystals, 5% acetic acid (28%). The temperature is raised to boiling in 15 minutes and boiling is continued for 45 minutes.

1% sulfuric acid (conc.) is added and boiling is continued for 30 minutes. The wool is rinsed, extracted and dried.

Class 3

1% Patent Blue A
(Colour Index 714)

The dyeing method is the same as for Brilliant Milling Blue B above.

Class 4

1% Alizarine Sky Blue B
(Colour Index 1088)

The dyeing method is the same as for Brilliant Milling Blue B.

As in the Fulling tests, silk was taken as the criterion in judging staining.

The Sub-Committee is of an opinion that these standards come as near to filling the requirements set, as any others which might be considered, and therefore have adopted them as final and are having them published as such in the Year Book for 1932 of the A.A.T.C.C.

Acknowledgment

This investigation was made possible by a grant to the American Association of Textile Chemists and Colorists by the Textile Foundation. We wish to express our appreciation for the aid given.

MARCH MEETING, NEW YORK SECTION

THE March meeting of the New York Section of the American Association of Textile Chemists and Colorists was held at the Elm Golf Club, Paterson, New Jersey. Mr. Henry F. Herrmann, Chairman of the New York Local Section, presided.

. . . During the business session, which preceded the technical program, the following motion was made by Mr. Harris, which was duly put and carried:

"I make a motion that we secure from the National Secretary a list of the members of the New York Section in good standing and also a list of those who have been dropped so that we can get after them, and that hereafter notices be sent only to members accredited to the New York Section and in good standing; notices to be sent out with a plain, unstamped return postal enclosed."

Chairman Herrmann: First of all this evening it gives me much pleasure to reintroduce to you an old friend, a gentleman who was formerly very active in our midst but who, from force of circumstances, was taken to one of our other sections. Mr. P. H. Stott of the Technical Division of the du Pont Company will speak to us on, "The Dyeing of Wool Mixed Fabrics." Mr. Stott! (Applause.)

. . . Mr. Stott then delivered his prepared paper, and exhibited samples of dyeing of the different fabrics. . . . (Applause.)

(See page (184) 280)

Proceedings of the American Association of Textile Chemists and Colorists

Chicago Invites the World

Proceedings of the American Association of Textile Chemists and Colorists

The A. A. T. C. C. Invites YOU!

THE world of tomorrow, the world of today and the world of yesterday will be on parade. Strike up the band and let's go!

Where? The Annual Convention, of course.

When? Friday, September 8th, and Saturday, September 9th.

We're making plans to have this the biggest and best Convention ever held by the A.A.T.C.C. and what we need to make it a success is your presence. Mark these red letter dates on your calendar and plan to see for yourself why Chicago is the wonder city of the world.

Where the magic of modern science will be portrayed in Chicago—The Hall of Science of A Century of Progress. This huge structure, 700 by 400 feet, is shaped like a U, and encloses on three sides a court capable of accommodating 80,000 persons. At one corner rises a 176 foot tower equipped with a carillon. The building faces a beautiful lagoon, an island and Lake Michigan beyond. At night it has the appearance of a brilliantly illuminated metal and glass creation, rising from colored terraces. On June 1, 1933, the science exhibits will be started officially by the light of the Star Arcturus, focused by means of a telescope upon a photo-electric cell. Arcturus is forty light years distant, so that the impulse which starts the science exhibits in 1933 left Arcturus in 1893, at the time of Chicago's first World's Fair.

Attractions of historic and educational interest that would require a trip half-way round the world if a person were to seek them individually will be within walking distance of downtown Chicago, where Convention headquarters will be located. By day the grounds of the Exposition will be a fascinating panorama of color, with crowds of people moving against the background of the windowless buildings. By night they will be transformed into a fairyland of light, bathing the buildings in mellow tints and projecting an ever-changing series of spectacular lighting effects.

The scenic beauties, industries and resources of the various states of the Union will be shown in a fascinating way in the great Hall of the States. The Exposition will be like an encyclopedia come to life with thrilling chapters told by means of animated displays.

The Textile Pavilion, in which the various branches of the industry will have an opportunity to exhibit, will be a part of the General Exhibits Group. These exhibits are expected to be moving, dynamic displays that will show some interesting processes of manufacture.

The production of various textile products will be actually shown—demonstrating how modern machinery under skilled operators produces wearables for men, women and children and fabrics for home adornment in large quantities at low cost.

The fabrication of hosiery before the eyes of the visitors can be shown so dramatically through exhibits that those unfamiliar with the processes will marvel at the low price at which quality products are available to the public. The story of silk and rayon will be told. The evolution of wool, from the sheep to the finished garment, via textile machinery will be presented. Mohair, cotton goods, sheets and pillow cases, dress fabrics, carpets, rugs, blankets, underwear, shirting material, clothing, etc., are among a few of the other textile products that have a story to tell that will be of interest to millions.

Do you wonder that we urge you to attend the convention? We haven't even started to list the attractions, but you can't stop us. While we pause for breath, let us repeat our invitation. Attend the A.A.T.C.C. Convention on September 8th and 9th and, at the same time, see Chicago in its most dazzling, glamorous array.

Proceedings of the American Association of Textile Chemists and Colorists

The Dyeing of Wool Mixed Fabrics*

By **P. H. STOTT**
E. I. du Pont de Nemours & Co., Inc.

THE commercial and industrial development of fabrics consisting of mixed fibers may be traced to a variety of reasons. Probably the more important of these reasons are:

1. Imitation of superior quality goods at a lower cost to supply the public demand for such material.
2. The development of new fibers such as acetate silks, immunized cotton, etc., leading to
3. The manufacture of goods having definitely contrasting effects of design and color between the fibers and
4. The introduction of new synthetic dyestuffs to make possible the production of such color contrasts which enhance the merchandising value of combination fabrics.

The textile industry as a whole, has capitalized on the possibilities of the use of mixed fibers to no small extent, and inasmuch as wool is the predominant fiber used in the manufacture of out-of-doors wearing apparel for use in all but purely tropical climates, it is only to be expected that combinations of wool with other fibers should take their places in the general sphere of usefulness.

The problems to be considered in the dyeing of mixed goods of any structure are obviously only two-fold as far as color itself is concerned. First, the dyeing of solid shades, and second the production of contrasting effects between the component fibers. In each case it is necessary to know what the fabric consists of, and preferable to know approximately the amount of each fiber present. This knowledge is obviously necessary to the successful dyeing of the fabric, and will decide what colors are to be used, and in what quantity to avoid waste, and will also at least influence, if not determine, the modus operandi of dyeing. It is assumed that the average textile chemist is familiar with methods for identification and determination of the various fibers, but it might be well to inject at this point a reference to the new textbook on Textile Analysis by S. R. and E. R. Trotman (Charles Griffin & Co. Ltd., London, 1932). This includes a valuable chapter on the identification and determination of textile fibers, and also to refer you to an article on this subject appearing in *The Silk Journal and Rayon World*, June, 1932, by Krais & Markert.

Fabrics consisting of more than one fiber can be made in several ways, and there are several methods used for dyeing them, according to the type of goods involved.

1. The individual fibers may be dyed separately and woven together; or stock dyed, mixed and spun together before weaving.

2. One fiber may be dyed, then woven with another fiber in the grey and subsequently piece dyed.

3. All the fibers may be woven in the grey and eventually dyed in the piece.

Generally, methods 1 and 2 permit of the production of faster shades such as are required for cheap suitings, and for pile fabrics with a cotton back, which has been warp dyed with sulfur or similar colors to withstand subsequent cross-dyeing. Method 3 usually is cheaper and has the added advantage of permitting the storage of grey goods rather than dyed yarn or stock.

For the purpose of this paper we have to consider the various structures of fabrics usually encountered in the trade; and listed in the order of their importance, combinations of wool with cotton, silk, and viscose rayon appear to cover the field, except that combinations with Acetate rayons and immunized cotton may very infrequently be used. Then, of course, there are multiple fiber possibilities such as wool, cotton and silk, or wool, silk and viscose rayon. In order to complete the picture we can advantageously classify at this point the types of fabrics likely to be encountered having compositions as indicated and then, guided by the nature of each fabric, go on to a brief study of the dyeing problems it presents.

Wool-Cotton

Under this heading we have the following materials to consider as being of major importance.

1. Cheap suitings, overcoatings and dress goods. These materials may be either of fancy weave such as imitation tweeds or constructed of a cotton warp and wool filling. The former styles must, of course, be dyed before weaving, and consequently present no problems which are within the scope of this paper. Suffice it to say that considerable faster shades can be obtained in most cases on

*Presented at March 24th Meeting, N. Y. Section.

goods of this type owing to greater possibilities of color selection, and the resultant cloth can as a result be subjected to severer wet finishing operations than is the case in most union dyed materials. Suitings which are composed of a cotton warp and wool or shoddy filling are dyed in the piece, and it may be safely claimed that the success of modern union dyeing has been made possible by the development of dyestuffs which possess comparable affinity for vegetable and animal fibers in the same dyebath, together with colors possessing selective affinity for the separate fibers so that they can be shaded at will to establish the correct balance.

2. Cotton-back mohair filled plushes, astrakhans, sweater and similar fabrics.

In the former case the cotton warp is usually dyed with sulfur colors, azoic, developed or even vat colors which will withstand a subsequent cross-dyeing of the animal fiber with fast acid colors or in rarer instances with chrome colors. This type of material must possess superior fastness properties to union dyed goods. Used as it is for upholstery, automobile fabrics, etc., its fastness to light and rubbing must be unquestionable. The use of two tone effects to give the fabric individuality and character is frequently resorted to, and the beauty of the mohair is retained by the finishing operations made possible by the use of suitable dyestuffs. Astrakhans and sweater fabrics with two tone effects are not so frequently encountered, and these are mostly woven or knitted in the grey and subsequently dyed by the union method. It is possible, however, by color selection to create two tone effects in one bath as will be touched on later. This is sometimes done in special cases.

3. Hosiery, wool lace and blankets.

A consideration of the above brings us about to the end of the more important wool-cotton combinations.

The use of wool hosiery is practically limited to golf stockings and boys' hosiery, and generally these run to heather or other patterned styles, and consequently fall in the same category as tweeds as far as dyeing problems are concerned. Wool lace with a cotton net has enjoyed quite a little popularity at times, and this is practically all dyed with union colors. Wool and cotton blankets are generally stock dyed and the fibers blended before spinning or weaving.

We can now proceed to a more detailed consideration of the various dyeing methods in general use for coloring the various styles of fabric described above, and we find the following methods at our disposal.

1. Dye the whole piece at one time with suitable union colors and shading colors for the individual fibers.

2. Dye the cotton warp and cross-dye the wool in the piece.

3. Dye the wool with acid colors and fill up the cotton in a mildly alkaline bath with suitable direct colors having little or no affinity for wool.

4. Dye the wool with acid colors, mordant the cotton and dye with basic colors in a cold bath. This method is very rarely used in modern dyehouse practice.

The first of these methods may conveniently be referred to as the union method or one-bath method and is of major importance. By far the largest percentage of wool-cotton, and even three fiber materials are dyed in this manner. Suitings, overcoatings, sweater fabrics, astrakhans and lace all lend themselves admirably to coloring by this method. As previously mentioned it is obvious that the success of the method depends on a knowledge of the quantitative composition of the fabric; the properties of the dyestuffs at our command, and, need one add, careful manipulation in the dyehouse.

The dyestuffs necessary for this style of work fall into three classes:

A. Direct colors producing an approximate balance between animal and vegetable fibers.

B. Direct colors which dye cotton but leave wool substantially unstained.

C. Neutral dyeing acid colors which dye wool but do not appreciably stain cotton.

Inasmuch as no dyeing assistants other than Glauber's or common salt are used, the dyestuffs must possess the above properties when applied from a neutral bath. There is no dearth of these colors in almost any shade, and any dyestuff supplier can give complete information on their use, and what effects can be expected under variables of temperature, time and so forth. Very briefly one may state that cotton has greater affinity below the boil, while wool and silk have greater affinity at the boil, so that the depth of color on each fiber can be controlled within certain limits by temperature and time manipulation. It is very preferable in this type of work to have the cotton heavier than the wool to prevent a mottled appearance, and probably the best method to achieve this result is to start cold, raise slowly to a light boil, maintain this temperature for 20-30 minutes and then continue dyeing in the cooling bath to fill up the cotton still further.

A variety of effects can be obtained with the same color by varying the dyeing conditions, and I have a few illustrations of this feature for your examination. These will illustrate the differences obtainable with the same color by the following methods:

1. Enter cold, bring to boil in 20 minutes, boil gently 10 minutes and run cooling 20 minutes. Union method.

2. Enter at 160°F., raise to boil in 10 minutes, and boil vigorously for 20 minutes. Wool much heavier than cotton.

3. Run at 120° F. for 1 hour with 2 lbs. of soap and ½ lb. soda ash. Cotton dyed-wool clean or white.

You will notice the contrasting effects on each fiber by the various methods.

Method 3 is known as speck dyeing, and is largely used in all kinds of union dyeing to fill up the cotton or

in shoddy dyeing to cover cotton specks and shives, and can be done very satisfactorily in the washer using the heavy roll to aid the penetration of the cotton. We referred to this practice in our original classification of dyeing methods and nothing further need be said except to again call your attention to the fact that there are many colors available which are eminently suitable for this purpose.

In mentioning the remaining possibility, namely, that of piece dyeing goods with a fast dyed cotton warp, it is probably only necessary to say that this presents no particular difficulty as there are many fast acid colors available which dye wool or mohair from an acetic acid bath, and which leave cotton virtually unstained. In cases of this kind therefore it is just a question of dyeing to shade with the most suitable colors.

Under A, B and C were mentioned three classes of colors to produce certain effects, and at this point it might be well to mention a few of these dyestuffs.

A. Direct colors producing an approximate balance between animal and vegetable fibers.

Direct Fast Yellow NN	Direct Blue R W
Congo Orange	Direct Brown N3G
Direct Fast Red 8BL	Direct Black E
Benzo Purpurine 4B	Direct Green B

B. Direct colors which dye cotton but leave wool substantially unstained.

Stilbene Yellows	Fast Scarlet 4BA
Fast Yellow RL	Direct Blue 2B
Mikado Oranges	Diazo Black BH

C. Neutral dyeing acid colors which dye wool but do not appreciably stain cotton.

Azo Yellow	Cyanine Blue
Orange II	Acid Violet C4 B
Fast Red A	Acid Black BBO
Wool Blue BL & GL	Milling Green B

The above lists, of course, can be materially augmented.

In dyeing combinations of wool-cotton and silk similar methods are suggested to those employed for wool and cotton owing to the similarity in affinity for color existing between wool and silk. The lustre of silk is something which cannot readily be hidden especially if present in a pattern or on the surface of the goods. Frequent spun silk is used for work of this type, and this is easier to cover owing to its comparative lack of luster. Sometimes it is necessary to dye a wool-cotton piece containing a pure silk effect thread, and in cases of this kind it is essential to carefully and thoroughly resist the dyed silk by successive treatments with tannic acid and tartar emetic before the cloth is woven. Silk treated in this way will not absorb the dyestuffs usually used for union dyeing except in very dark shades.

Wool-Viscose Rayon

Combinations of these fibers are found in Jersey cloth for dress goods, sweater fabrics and hosiery to mention those of major importance. Substantially the same methods can be employed for dyeing as are used in wool-cotton combinations, bearing in mind that rayon has greater affinity for most direct colors than cotton, and therefore modification of the dyeing methods as to temperature and time are necessary. This will be particularly true in medium to dark shades. Sometimes the rayon is used as a decorative fiber to be left white, and in cases of this kind the dyeing should be done from an acid bath with acid colors having little affinity for vegetable fibers. The rayon can, if necessary, be cleared in the final rinsing by the addition of a little hydrosulfite.

Wool-Silk

Under this heading we have to consider Gloria cloth, lace, hosiery and men's wear. Wool-silk fabrics used for ladies' dress goods and umbrella cloth are composed of a silk warp and worsted filling. The dyeing of this fabric can be done very satisfactorily with acid colors possessing equal affinity for wool and silk from an acetic acid bath cleared with sulfuric acid but the neutral dyeing acid colors are probably best suited for this work. Colors of the DuPont Milling series are unusually satisfactory for dyeing wool-silk combinations of all kinds when solid shades are desired. They dye well from a neutral bath cleared with a little acetic acid, and possess better than average general fastness properties.

Two-toned color effects on wool and silk are not often required in piece goods. Such fabrics as wrinkle-proof neckwear and hosiery are generally dyed in the yarn before weaving. However, if shot-effects are required they are usually produced in two baths, the wool being first dyed with suitable acid colors to leave the silk white at the boil. A strongly acetic acid bath is desirable and the goods must be vigorously boiled. If necessary the silk can be cleared by a rinsing in weak hydrosulfite and then dyed in a cold bath containing acetic acid with basic colors for contrasting effects. Some of the direct cotton colors can also be used for this purpose since the affinity for silk at low temperatures is better than for wool. Lace will be dyed practically along the same lines as Gloria, and as in all types of union dyeing temperature control is an important feature.

White or colored pin stripes and other effects in suiting fabrics are always produced by dyeing the wool with suitable acid or chrome colors which do not stain silk. For colored effects the silk is dyed before weaving with colors which will resist the cross-dyeing process. Vat colors are probably the most satisfactory for this purpose.

Before closing it should be mentioned that wool and acetate rayons and immunized cotton combinations have very little importance as yet in the industry, and it is doubtful if they ever will have, as no particular advantages are to be obtained by their use, and all necessary effects can be made on the three more staple fibers previously discussed.

Much has been written and said on the subject of union dyeing, and in conclusion I can only again recommend to those of you who are interested in the subject to determine the composition of the fabric to be dyed, and to study the effects of time and temperature on the many colors available in relation to the fabric's composition to obtain the best results possible.

The author acknowledges the suggestions and assistance given him by Messrs. C. A. Seibert and W. J. Zinck of the Technical Staff of E. I. du Pont de Nemours & Co., Inc., in the preparation of this paper.

Discussion

Chairman Herrmann: Gentlemen, you have heard what the "Doctor" has to say about union dyeing. There may be some question that the "Doctor" has not touched on. If so, why the "Doctor" would like to have them.

Mr. Barbour: Mr. Chairman, as a manufacturer, not a chemist or a dyer, I would like to say that I think he has overlooked the fact that acetate rayons have been very popular recently. In fact, I might safely say that there have been hundreds of thousands of yards dyed in this vicinity in the last two or three months. Any amount of ladies' dresses have been made up, bought and worn.

Mr. Stott: In combination with wool?

Mr. Barbour: Acetate rayon alone.

Mr. Stott: I realize that acetate rayon is a very important fabric.

Mr. Barbour: Before you get through I want you to explain to me as a manufacturer what we are going to be up against in the next three months when the lady wants to have her dress cleaned or washed, because in my experience in dissecting these fabrics, I find that in acetate with the rayon filling, when you begin to pull the pick, the acetate warp simply goes up in powder.

As manufacturers, are we going to get into a lot of trouble that is going to condemn that kind of a combination? As a representative of du Pont I thought you might known something about that. I will show you a sample of the cloth that is being put out. Probably you have run into it. What I have stated may interfere with its further development as a dress material.

Mr. Stott: This is not quite in the subject of the paper. I made the statement that acetate rayon or acetate silk as we will call it, was not used very much in combination with wool; but of course, that did not mean that it was not being used. We all know, of course, that acetate is a very important fiber and is being used, as you say, as a self fiber and also in combination with viscose rayon. One reason why it is being used in combination with viscose is because they have not yet been able to find a method of creping all acetate fabrics.

Mr. Barbour: Not satisfactorily, no.

Mr. Stott: I believe that is right. But why there should be any particular difficulty about cleaning combination fabrics of that kind, I really don't know.

Mr. Barbour: What brought it to my mind is the fact that there does not seem to be anything left in the acetate yarn. The least friction powders it up.

Mr. Stott: Perhaps it has been treated rather roughly.

Mr. Barbour: I do not think so. I have had it from many different dyers.

Mr. Stott: Have you any idea how it has been treated?

Mr. Barbour: Oh, no.

Mr. Stott: It would be essential to find out. Obviously if you take acetate and boil it or treat it with alkali or alkaline soap at a high temperature, it is going to be saponified and lose a certain amount of its characteristics.

Mr. Barbour: The only method they have of scouring is with a good pure soap bath before dyeing. That is the thing I am running into—whether we are going to have a lot of trouble with the manufacturer, the dress manufacturer, which will result in giving it a black eye.

Mr. Stott: I have not encountered very much difficulty along that line. If you could find out, though, just how the goods have been treated, I think that probably would throw some light on what to expect. Did you say it was a question of dry cleaning also?

Mr. Barbour: Either dry cleaning or washing. The women who buy dresses don't know what to do. Some of them wash and some dry-clean. When they come to put them on again, we don't know what is going to happen.

Mr. Stott: If they wash a dress at wrist temperature as most women do, there certainly should be no question of the decomposition of the acetate, even if they do use an alkaline soap, particularly if it is Acele, because Acele is somewhat more resistant to hot soap than other acetate silks.

As far as dry cleaning is concerned, unless they have got some ethyl acetate or acetone or some other solvent for the acetate yarn in the dry cleaning solution, I do not know of any reason why it should dissociate.

It is an interesting subject and I would like to know how they are treating it. Perhaps some other men have had some experience along that line. I have not.

Chairman Herrmann: I think probably the best thing for us to do would be to devote some evening to acetate fibers. Then we will cover that subject thoroughly. Are there any further questions on the subject of union dyeing involving wool?

If not, I would like to ask Mr. Stott a question. There seem to be two classes of dyers who have a different approach in the combining of colors for mixed goods. The one class favors the use of substantive colors that dye both fibers more or less uniformly, and merely touch up the wool fiber with such neutral dyeing acid colors as

may be necessary in order to bring the two shades alike.

Then there is the other class that deliberately selects cotton colors that dye only the cotton and will not dye the wool, and dye the whole shade of the wool with neutral dyeing acid colors, claiming that by using the selective colors they can better control the union dye effect, whereas with the colors which have a natural union dyeing tendency, it is difficult to control the proportioning of the absorption on the two fibers.

Mr. Stott: Well, I suppose that is largely a matter of opinion. To get away from the subject for an instant, I know that a lot of hosiery dyers—this applies, I think, particularly to the South—will use as many as six or eight colors for dyeing silk and cotton hosiery, using similar colors as mentioned by Mr. Herrmann, to dye the cotton and also using separate colors to dye the silk. They claim that they can control their shades better in that way.

Of course, I think that with prevailing light shades control may be easier, because after all if you are using a union color (this applies also to cotton and wool as being related to cotton and silk), in light shades, as you will see from the dyeings that have been passed around, one has to be exceedingly careful in temperature manipulation and time, the proportion of the fibers, and the length of the bath. Some people will prefer to dye in a short volume of 20 to 1; others like to dye in a volume of 40 to 1. All those things contribute to unevenness of balance between the two fibers.

If a man dyeing medium or light to medium shades has at his disposal a range of colors which will not dye wool and a range of colors which will not dye cotton, when dyed at a constant temperature of, let us say, 180 degrees, his chances of getting a better balance between the two fibers, I think, would be improved by that kind of color selection in light shades.

In dark shades such as navies, blacks, dark browns and things of that kind I think he would be better off to start with a union dyeing color and touch up the individual fibers after the goods have run for a certain length of time. It is a very easy thing to do that right at the kettle. He still could come back to the colors which would dye cotton or wool, as the case may be, and lower his dye bath temperature for the final shading. However, I think probably in light to medium shades he might get better results if he used separate colors for the two fibers.

Chairman Herrmann: Thank you.

Are there any further questions? You know this is a great big question. After all, the day of pure wool is almost over. Something has to be done about getting the cotton to look like wool.

If there are no further questions we will proceed to the next paper, and I take pleasure in introducing to you Mr. A. A. Dessow of the Interstate Chemical Company who will speak upon, "The Moth—Friend or Foe?" Mr. Dessow. (Applause.)

. . . Mr. Dessow then presented his prepared address . . . (Applause.)

(*See next page*)

THE COMBINATION OF SILK AND WOOL WITH POSITIVE AND NEGATIVE IONS

(Continued from page (178) 274)

A second set of wool samples were treated with a 5 per cent solution of $NiCl_2$ in a pH range of 1.2 to 7. After 24 hours the samples were washed with corresponding buffer solutions until no nickel was detectable in the sample at pH 1.2. The wool was then treated with an alcoholic solution of dimethyl glyoxime. Below pH 2 the wool was colorless. At pH 2 a light pink color appeared and increased in samples treated with solutions of increasing pH.

Similar experiments were carried out with silk. Since the acid and basic binding power of silk is very weak, no sharp changes were detectable. The experiments indicated roughly, however, that silk combines with ferrocyanide up to about pH 4 and with nickel down to about pH 1.8.

V. Conclusions

The results of these experiments are in accord with those obtained by Northrop and Kunitz, Carroll and Hubbard, and Pauli and Schön. Taking the values for the isoelectric points of silk and wool to be at pH 2.5 and pH 3.4 respectively, they show that combination with positive or negative ions may take place within a certain range on both sides of the isoelectric points of these proteins. Consequently values of the isoelectric points obtained by determining the pH limits of the combinations of positive and negative ions with silk and wool do not necessarily represent the isoelectric points of these substances, but indicate the point above or below which the fiber combines with a given ion. The mean of these limits may give an approximate value for the isoelectric point.

VII. Acknowledgment

This investigation was made possible by a grant to the American Association of Textile Chemists and Colorists by the Textile Foundation. We wish to express our appreciation for the aid given.

CALENDAR OF COMING EVENTS

Meeting, Research Committee, Chemists Club, New York City, April 28.

* * *

Meeting, New York Section, Chemists Club, New York City, April 28.

Proceedings of the American Association of Textile Chemists and Colorists

The Moth—Friend or Foe?*

By **A. A. DESSOW**
Interstate Chemical Co.

IN PREFACING articles on the subject of moths it is usual to quote staggering figures, running into uncounted millions, indicating the economic loss directly attributable to the ravage of this particular insect pect. In place of quoting a wealth of statistics, no doubt well founded, exemplifying the point, we may feel assured from general experience, whether as manufacturers, merchants or individuals, that the moth actually is an ever-present menace in those lines of endeavor where wool, hair, fur and feathers enter into common use; that this menace has existed for centuries past, and its existence is recognized in the fact that individually or collectively we seek and employ some measure or other whereby we attempt to effectively combat moth destruction and preserve to ourselves the value of such wool materials of which we are possessed, and which are the natural prey of the ravenous moth.

The life cycle of the common moth found in our homes, factories and warehouses, is already quite well known through literature widely circulated by Federal and State agricultural departments, and other reliable agencies, so that you need not be burdened at the moment with a detailed exposition in this respect. In touching briefly on the life of the moth, we find four stages starting with the egg, grub, pupa and miller phases. Of these four stages the grub or larval stage demands most serious consideration, as it is in this stage only that actual moth damage occurs through the feeding of the grub, and reference here to the moth concerns chiefly the grub or feeding stage. The moths or millers which we see flying about create no actual damage of their own for they do not feed upon fabrics, being for the most part males who have lived their short life span. The female miller is seldom seen flying about due to its excessive weight through being loaded down with eggs, and it prefers to crawl about in dark corners and crevices laying its eggs in and about clothing and other objects subject to attack. Due to its habit of seclusion it is seldom seen and after depositing its eggs which in some instances total 150 and even more during its short life span, it has accomplished its life work and soon dies. The newly laid eggs under proper conditions hatch within seven to eleven days, although at low temperatures they have been known to lie dormant for indefinite periods, thus extending the time of incubation. Upon hatching the new born grubs or larvae immediately start feeding upon any immediately available wool material. The period of feeding lasts from two weeks to two months, according to individual cases, the presence of suitable food and conditions of temperature and humidity. Near the end of the feeding period the grub forms its cocoon and usually after eight days in its pupal casing the full grown adult miller emerges, and with the successive laying of new eggs the life cycle is once more repeated. Ordinarily we anticipate one generation of moths annually, the eggs hatching during spring and the feeding stage continuing during the summer. However, with the almost universal use of steam-heated or centrally heated buildings, it has been found that even two and three generations of moths can breed within a single year. As an example of this an experiment is on record wherein moth eggs have developed into fully grown millers within the space of fifty-four days.

In recognizing the necessity for moth preventive measures, we find that in all times materials of some sort were employed for moth destruction, ranging from the fragrant herbs and spices of the ancients to the present-day assortment of odoriferous and noxious concoctions so liberally distributed to our consuming public, practically all of which have proven inadequate or wholely useless. In fact, some of our grandparents inclined to a wholehearted belief that common pepper was effective against moths, and similar belief applied to liberal dusting with tobacco, the desirability of both methods being open to question, unless one delighted in wearing pepper or snuff laden garments, or cared to enjoy the use of similarly treated furnishings in the home. The net result must have been harder on humans than on the moths, as we find the method in no wise deterred the moth. In later years the theory was advanced that wool material wrapped in newsprint would exclude moths, although experiment along this line has proven that newsprint does not deter ingress or egress of the moth grub, and we have seen newspaper wrapped packages of wool literally riddled by moths. Other methods of protection, including beating, brushing, exposure to sun, and frequent disturbance, although of some value, leave entire satisfaction to be sought, because of necessarily frequent repetition, and a loss in labor and time. In recent years we find an endless array of powders, spray solutions, flakes, perfumed tablets, vaporizing

*Presented at meeting, N. Y. Section, March 24th.

devices, including the old reliable camphor balls and naphthaline crystals, all intended as moth preventives, but none of which are dependable in effect, due undoubtedly to the fact that their effectiveness depends on odor, and being volatile in nature any possible protection ends with dissipation of the fumes created. There is belief that these smelly compounds are effective if used in certain proportions per cubic foot of space in hermetically sealed containers, chests or closets, which is an impractical procedure, at best, and recognized authorities who have scanned the roster of all these preparations, agree there is room for considerable doubt as to their effectiveness, and in fact, a majority of these compounds fall into the class of being entirely worthless.

These strong smelling compounds do not kill the egg nor do they prevent the grub from feeding; as to the effect on the female miller these odors apparently make her even more restless resulting only in a more rapid and liberal depositing of her eggs. Fumigation stands quite high in the estimate of moth prevention as proper fumigation well carried out does exterminate all life, but in this operation a newly fumigated wool article offers no future protection and is liable to immediate re-infestation. The same can be said of dry cleaning as there is a belief that dry cleaning prevents moth ravage. Assuredly dry cleaning will kill moth grubs and sterilize eggs by direct contact but there is no evidence that a newly dry cleaned garment or article is definitely immunized to re-infestation.

With these facts in mind a group of prominent German research chemists undertook a thorough study of the moth some years ago, with a view to devising a method of moth control, entirely different from methods known previously, seeking to eliminate the known disadvantages of moth prevention, and perfecting a process that would definitely immunize wool against moth attack, hitherto unthought of, i.e., an application of chemicals directly to the wool, making it resistant to the destructive moth grub for all time, and still retaining all the valuable properties of the wool, without unpleasant odor, poisonous effect, or the necessity for frequent and repeated application. Extensive research in both biological and chemical fields, resulted in the invention and production of the mothproofing compound now known as "Eulan" and the credit for this progressive achievement is most generally given to this group of scientists. Their invention offered a definite and positive means of combatting the moth, through permanently mothproofing wool in a single application, and this without in any way affecting the color, handle or durability of the wool. In connection with the numerous and varied experiments required over a period of years which culminated in the discovery of Eulan, a unique system of moth testing was evolved which is in use today and which is an accurate indicator of the efficiency or non-efficiency of any given mothproofing preparation. Preliminary to conducting such tests, it is required to breed and propagate moths and grubs which naturally covers the entire cycle of life. In conducting such tests, materials are subjected to attack by active live grubs kept under proper conditions of temperature and humidity. The result of the test indicates the value of the mothproofing by visible evidence as to whether or not the material under test suffers damage.

In further recognition of the necessity for moth control, it is interesting to note that the advent of Eulan promptly aroused a sense of "moth-consciousness" inasmuch as numerous imitations of this original product were soon offered on the market, the majority of which were short lived. In fact, of all present-day mothproofers the U. S. Bureau of Standards and the Department of Agriculture recognize only two mothproofing brands as meritorious, and we may modestly admit that Eulan ranks as premier.

In step with progress Eulan has been constantly improved, since its introduction some years ago, endeavoring to simplify the method of application, and rendering even greater degrees of satisfaction, chief of which is permanency.

The more modernized brands offer such advantages as being capable of application in conjunction with a dyeing process, thus eliminating a separate mothproofing operation, and embody resistance to rinsing and washing even in soap and warm water, resistance to dry cleaning, exposure to sun, rain and salt water, steaming and hot pressing. It is interesting to note, in offering modern mothproofing of merit to textile manufacturers and merchants which they in turn could pass on to the consumer, a tendency on the part of some to consider the moth as a "best friend" which may well lead to the question of whether the moth is friend or foe. Something can be said for each side of this question.

Some textile manufacturers maintain that a mill in active operation is not conducive to moth infestation, so they have no individual requirement for moth protection, and after merchandise leaves the mill their wish is that the moths speedily destroy it, so that they may secure repeat business. There is reason to doubt whether the extent of moth ravages result in immediate replacement of the damaged material or article, because your consuming public is not always disposed to a new purchase—rather they are inclined to repair or patch the damage to get the ultimate use from the article in question, which holds the anticipated repeat business in the offing and it is problematical whether the bulk of new business going to mills is due to wear, tear, mechanical destruction, obsolescence, changing fashion, or the destruction set up by moths.

Other manufacturers by the nature of their business

are required to keep large stocks of wool in storage, and admit the existence of a moth problem within their own premises, which they strive to overcome by periodic spraying, or fumigation, an expensive procedure at best, requiring constant vigilance. Such manufacturers believe in protection for themselves, but here again we find the same defense against mothproofing—disinterest in the material or article after it leaves the mill, and the implied hope for speedy moth destruction.

Either class of manufacturer may find interest in a few facts that are based on observation covering a period of several years. First among these is a preference on the part of the purchasing public for articles and materials that offer immunity against moth attack, such as silk, cotton, rayon, linen, and we find wool fairly well discriminated against because of its susceptibility to moths. This is evidenced in women's wear, floor coverings, furniture and home furnishings. We find expressed preferences in such instances as silks, rayons, and linens in place of wool dress goods, art linoleums in place of carpets and rugs, cotton and rayon coverings for furniture in place of mohair, and various union fabrics as drapes which are supplanting velvet hangings. To aggravate the matter we frequently encounter printed articles published in the women's home papers and magazines stressing the possibility of moths in woolens, and there is one instance where agitation of this sort has seriously hampered an outstanding industry, i.e., the mohair plush trade.

We find further that some manufacturers of 100% cotton materials capitalize the moth, by offering and advertising their wares as "mothproof" as well they might, and most successfully too, accenting the fact that woolens properly mothproofed would have equal public appeal.

In view of this it might well be considered that the moth is a real foe to the wool manufacturer and merchant, not only as a destructive pest, but in curtailing the output and turnover in woolens.

The moth, however, can be turned into an ally of the wool manufacturer and merchant, and prove a valuable friend, although not in the sense previously referred to. It is possible to have the moth work for you, in a sense, and thereby produce an extra profit, besides affording your selling staff an added selling feature. The general use of mothproofing of recognized merit and dependability points the way. The cost of the treatment should not prove the most vital factor in considering mothproofing, as it is possible to recover this cost, with a percentage of profit added, due to the fact that the purchasing public recognizes an improvement in quality and service, and mothproofed wool insures maximum satisfaction.

Our impression in this respect can be borne out by the fact that annually each householder invests a considerable amount in attempting moth-prevention, repairing moth damages, reweaving rugs, and the like, and the assurance that such expenditure may be avoided by the payment of a slight increase in price in the purchase of new materials and articles, properly mothproofed, will not act as a deterrent in their sale, rather the feature should encourage the greater use of woolens of all sorts.

We may mention in concluding, that an actual outlet for real mothproofing exists, evidenced by the dozens, if not hundreds of moth preparations of doubtful worth vended through drug stores, department stores, etc. We consider at the same time the number of concerns specializing in extermination and fumigation, and the specialized so-called demothing or mothproofing service stations throughout the country, all of whom reap the harvest from money so freely spent by the public for moth prevention that really does not prevent. It is logical to assume that a fair proportion of these profits could be converted to the benefit of the wool industry through featuring genuine mothproofing, which we commend to the consideration of astute and forward looking wool people everywhere.

Discussion

Chairman Herrmann: Have you any questions for Mr. Dessow?

Mr. George L. Baxter: Is Eulan used in any way as a spray or to protect garments which have already been made up?

Mr. Dessow: It can be used as a spray under heavy pressure, but it is not recommended for use on garments due to the fact that dependable mothproofing depends upon the complete saturation. If you take a finished garment and saturate it, you naturally create shrinkage and pull the garment out of shape, perhaps getting puckers along seams, lapels, etc.

So in recommending spraying of Eulan we do suggest that it is very practical on rugs and furniture but when it comes to doing finished overcoats, and suits, we leave it to the discretion of the individual operator.

Mr. Baxter: What I have in mind is in connection with suits. I wonder if you know enough about your competitive products, then, to know what there is in them that would affect such a thing as a celanese lining in a wool suit?

Mr. Dessow: Well, I have heard of some products which are water solutions containing considerable acid, and I believe in celanese linings there is a possibility that acid coming in contact with them will cause a change in color.

Mr. Baxter: You don't know what acid that is?

Mr. Dessow: It is liable to be hydrofluoric acid because most of the mothproofing material that has been on the market and one or two now on the market depend chiefly on fluorides for their operation, and the possibility is that the acid that comes into consideration is some hydrofluoric derivative.

Mr. Baxter: It works out so that the acid affects only that portion of the garment which is touched by the hanger.

Mr. Dessow: That may be due to the fact that if the garment is put on the hanger in a wet condition the action of the solution against the varnish or the shellac that is on the hanger may have an effect on the celanese.

Mr. Stott: Is Eulan soluble in organic solvents such as benzol?

Mr. Dessow: The present Eulan brands are not soluble in organic solvents. They are solely water applications.

Mr. Stott: Of course, the possibility of dissolving them in organic solvents would increase the possibility of penetration on such things as mohair, etc. The water, of course, won't go through to the back and the moths rarely eat the pile. They usually eat the knots at the back of the warp and the pile drops out.

Mr. Dessow: In that relation I might point out that all of the Eulans are so prepared that they will give a thorough penetration. They contain special penetrating mediums.

Mr. Stott: Are they neutral in reaction?

Mr. Dessow: They are neutral.

Mr. Leupold: I would like to ask Mr. Dessow a question. Are there any laboratories or experimental stations in this country where one might test the effectiveness of treated cloth?

Mr. Dessow: There are none that I know of definitely that are in position to do the work. We had occasion quite recently to make an inquiry along that line. People that we logically thought could do that sort of work admitted that they were not equipped to do it chiefly due to the absence of live moth-grubs.

Mr. Leupold: How about the Bureau of Standards or the Department of Agriculture?

Mr. Dessow: The Department of Agriculture is equipped to carry on such work but I believe they only do it for their own interest and their own purposes. Whether they would be willing to do it for outside inquirers I don't know, although they are equipped to do the proper sort of testing down there. However, the technical schools and colleges that we have applied to just recently admit that they are not in position to do that sort of work.

Mr. Leupold: Thank you.

Mr. Howes: I might answer part of that question. I don't know about the present, but about two years ago Lowell Textile Institute was equipped to do it because I know that Professor Olney was having the felts on the piano that were very badly moth-infected replaced, and he said, "Save all the moths you can get and put them in tin cans and send them up to our laboratory because we need all we can get." I did. I sent him up a couple of tin cans of moths.

Mr. John E. Bell: Those tests are now being conducted by the U. S. Testing Company in Hoboken.

Mr. Drew: Is it possible for an individual to do mothproofing on furniture or does it require an expert?

Mr. Dessow: There is a very simple method of applying Eulan that I know of. It can be done with an ordinary sprinkling can. First have your furniture thoroughly cleaned and free from dust. Then take it outside some place, in the drive-way or on the lawn. Prepare your solution and apply, using a sprinkling can. You can thoroughly wet your furniture and allow it to get well saturated and just let it stand right in the sun and fresh air till it dries and you have a mothproofing job equal to any job that a professional servicer could give you. The professional servicer naturally depends upon a high-powered spray to do his work and save some time. The individual, if he feels inclined, can do the same job and get just as good results. I have done it myself on several suites of furniture and as yet nobody has made any claim that I have ruined anything, and they have not expressed dissatisfaction.

Mr. Stott: Does that treatment not have a tendency to flatten the pile of the mohair?

Mr. Dessow: We do not find that as a rule, although it is suggested that in finishing the mohair, after it is partially dried, say about ninety per cent dry, take a fairly stiff brush and brush against the pile. If you do that it will become erect again.

(Discussion will be concluded in next issue.)

EIGHTY-SEVENTH COUNCIL MEETING

(Continued from page (176) 272)

Associate:

Nathan, Ernest—35 Ontario St., Providence, R. I. Manager, Warwick Chemical Co., 100 High St., West Warwick, R. I.

Wolff, Gus—1225 Dilworth Road, Charlotte, N. C. Salesman, Procter & Gamble Distributing Co., 1416 Johnston Bldg.

The Secretary was instructed to communicate with the local treasurers regarding their reports for this year and last year.

Earle M. Edgerton and H. W. Baldwin were reinstated as members of the Association.

Mr. Cady spoke concerning the appointment of the Technical Committee for the Chicago meeting. No action was taken at this time.

It was voted that a full page be published in the Proceedings regarding the placing of unemployed members and former members.

It was decided to hold the next meeting of the Council in Washnigton, D. C., on March 31, 1933.

The meeting adjourned at 3:15 P. M.

Respectfully submitted,

A. NEWTON GRAVES, *Secretary*

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THE HOSIERY INDUSTRY

TODAY marks the opening of the twenty-ninth annual Knitting Arts Exhibition in the Commercial Museum in Philadelphia held under the auspices of the National Association of Hosiery and Underwear Manufacturers. This, undoubtedly, is the biggest event of the year for the knitting industry. Through the years it has grown to have a definite and well-earned function in its field and it has come to be regarded among buyers and sellers as well nigh indispensable. It is significant to note that year after year, the same progressive concerns find it well worth their while to continue their exhibits. The displays include every conceivable type of equipment, product or special service which is connected with this industry.

As the readers of this journal are particularly interested in one phase of the knit goods industry they will find much of interest in the finishing and dyeing exhibits. To those who are directly connected with the hosiery industry as well as those who have only a passing interest, the figures recently released by the Bureau of the Census are particularly significant. These figures reveal the fact, probably especially amazing to those outside the industry, that during 1932, production, orders and shipment of hosiery were all in larger quantities than during the preceding year. The following table shows this comparison (figures in dozen pairs)

	1931	1932
Production	50,981,783	53,321,327
Orders Booked	53,242,749	56,275,173
Cancellations	1,346,433	1,422,374
Net Shipments	52,691,621	53,994,358
Unfilled orders, end of year	2,222,350	2,877,384
Stock on hand, end of year	8,843,099	8,251,134

The figures do not represent 100% of the industry. They are taken from 284 identical establishments, which produced approximately 52% of the total value of hosiery reported at the 1931 census of manufactures. On this basis, however, it is apparent that the reporting mills represent well over 60% of the total unit capacity of the industry last year, and provide a suitable cross-section of the industry.

These figures are not to be construed as indicating that the hosiery industry is to be considered as a more profitable section of the textile industry than other branches, as the price of the hosiery comes in for no consideration. From the standpoint of profit, there is probably much justification in any complaints from the hosiery trade. However, when the figures are subjected to an analysis, they do show a healthy condition from any view point except price.

Both orders and shipments were larger than last year, stock declined substantially, and unfilled orders increased. Among the divisions of the hosiery industry the sharpest increase was apparent in full-fashioned hosiery for women, in which 1932 production was 20,306,500 dozen pairs, as compared with 18,592,944 dozen pairs in 1931, but in practically all branches of the business at least slightly better volume was shown during 1932 than in 1931.

It is important to note that the 1932 showing of the hosiery industry was in considerable part due to the sharp upturn that took place late in the summer and early in the fall. In September last year hosiery orders totaled 6,692,625 dozen pairs while in the corresponding month of 1931 the orders amounted to only 4,503,413 dozen pairs. In October, 1932, 6,582,373 dozen pairs were ordered and only 4,873,488 dozen pairs were credited to October 1931.

The heavy buying during the fall of 1932 was occasioned in part by a rise in commodity prices which has since fallen off. The movement of goods to the consumer which had been bought during this period was not all that was expected and that has resulted in a decrease of orders during the first quarter of 1933. We have been led to believe that the hosiery industry was in a much worse plight than it really is, and it should become obvious from an examination of the figures given herewith that the situation of this branch of the textile industry is not as bad as has been pictured, and its position in relation to the other branches may, in all fairness, be described as favorable.

Due to the importance of the hosiery industry, the dyeing and finishing of hosiery is likewise an important feature of that industry. When we consider that practically every pair of hose, with the exceptions of certain types of wool and cotton socks, is dyed and finished, the importance is readily apparent. The ever-changing styles of women's hosiery constantly present new problems in dyeing and finishing to the person engaged in this type of work. We should not under-estimate the possibilities of new processes, dyes, and developments in this field.

Textile Foundation News

Moths

Thirty million American homes, armed with one or more of several hundred "insecticides," wage almost constant war on clothes moths, yet the annual ravages of such pests cost us $100,000,000, states H. E. Ritchey, Textile Foundation Research Fellow in a report to Franklin W. Hobbs, Chairman of the Foundation. "We are trying to get at the root of that trouble by working on the development of fabrics with 'built-in' moth repellants," Mr. Ritchey states.

"Some of the multitude of patented mothproofs are ineffective, but the chief loophole for moth attacks probably lies in defective conditions of application. Sprays, for instance, are not applied thoroughly, or fumigants are allowed to escape through lack of air-tight chests or wardrobes. We are trying, therefore, to develop moth-repellent textile dyes to provide 'built-in' protection," says Mr. Ritchey, whose research at the University of Illinois is under the direction of Dr. L. R. Shriner.

"The habits of moths are their greatest protection," according to Mr. Ritchey. "They prefer dark places and are seldom seen in the light. The moth that seeks the bright lights and incites the housewife to frantic efforts is usually a harmless variety. His destructive brother works under cover and frequently goes undetected until the damage is discovered.

"There are over six hundred mothproofing materials patented, not including fumigants. Some of the most commonly used substances are paradichlorobenzene, naphthalene, carbon bisulfide and carbon tetrachloride. Of the many materials, some seek to kill the moth, others endeavor to nauseate him and thus divert his presence or his appetite. Some methods probably only lighten the moth's daily routine.

"The great number of 'proofs' attests to the serious need for protection against moth ravages, and would seem to assure adequate defense. In actual practice, however, few of the materials prove entirely satisfactory. Some are inflammable, others poisonous to humans, some malodorous, others difficult to apply, and still others are unsatisfactory because of their expensiveness.

"To be ideal, mothproofing materials should first be effective, have no objectionable odor, should adhere evenly to the fabric treated, be unrecognizable on the material, not dust off, not be toxic to humans, and be reasonably priced.

"Our research problem is to determine whether some of the most nearly ideal moth repellents can be incorporated in dyestuffs. There is only one dye on the market at present that is moth repellent. For practical commercial purposes and to accomplish widespread mothproofing through such means, it will be necessary to develop a wide range of such dyes.

"The crucial questions which must be settled in our investigations are whether a moth repellent will retain its properties when combined with dyes, and also whether such a combination can be effected without interfering with the qualities of the dyes."

Mill Sewage

Not all of the textile manufacturers' problems are confined to matters within his factory or even to the sale of his product. One serious problem arises from the disposal and recovery of mill sewage, asserted Stuart W. Cramer, Director of the Textile Foundation, in releasing today a statement by M. S. Campbell, Foundation Research Fellow.

"Domestic sewage disposal has been handled satisfactorily by sewage treatment plants, but with industrial wastes the high concentration of organic matter and chemicals makes it impossible to apply the same methods of treatment," explained Mr. Campbell, who is working on the problem of textile waste disposal at the University of North Carolina under Dr. H. G. Baity.

"Because of the large quantities of waste liquors resulting from the bleaching, dyeing and finishing processes," Mr. Campbell continued, "the textile industry is faced with the necessity of treating its wastes before discharging them into streams or sewage treatment plants. In some localities the problem is quite serious. North Carolina, for instance, has spent much money trying to discover a solution, but no generally successful method has been found.

"Stream discoloration is the most apparent objection to textile wastes, but the effect on the biological life of the stream is the most harmful result. Waste liquors are sterile when discharged from the mills, but are converted by micro-organisms in the streams. Organic matter in the wastes serves as food for these organisms, and is finally consumed by them and thus reduced to a stable form. This is the natural self-purification process of streams.

"These waste-consuming micro-organisms require oxygen for their life processes just as human beings do. If the quantity of waste is large, the dissolved oxygen off the water is depleted before stabilization of the waste occurs.

(Continued on page 294)

Rayon Dyeing and Finishing—4

By **B. L. HATHORNE**
Consulting Textile Chemist

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CHAPTER II—CONSIDERATION OF RAYON FROM THE VIEWPOINT OF THE PRACTICAL TEXTILE CHEMIST

(Continued from page 262, April 10 issue)

Effect of Textile Chemicals on Cellulose Acetate Rayon

Water

The fact that cellulose acetate rayon has the lowest regain of any commercial fiber, indicates that water acts differently on this fiber than on regenerated cellulose rayon.

Cellulose acetate is the most difficult of all yarns to "Wet Out" with water. This phenomenon does not interfere with the successful processing of this yarn within dyeing and finishing plants as the fabric can be completely "Wet Out" by continued running in a water bath. It is of interest because it indicates the extreme difficulty of penetrating this fiber with the various materials used in dyeing and finishing processes.

Cellulose acetate yarns when wet with water exhibit somewhat different physical properties than do regenerated cellulose rayons. Wet cellulose acetate fibers appear to possess the properties of a very viscous fluid in that they will flow in any direction depending upon the external force applied. When the external force exceeds the elastic limit, (which is quite low), the yarn is permanently distorted.

Alkalis

Cellulose acetates, like other organic esters, are very susceptible to saponification. When wet processing conditions are not carefully controlled (when temperature or alkaline concentrations are excessive), alkalis enter into a double decomposition reaction with cellulose acetate. When this action is allowed to go to completion, regenerated cellulose is formed. This is rarely desired, as it is accompanied by a loss of weight amounting to approximately 30%. Also, the resultant fabric loses all the advantages of draping qualities, feel, etc., that are inherent in normal cellulose acetate fabrics.

It is the practice in some dye houses to saponify cellulose acetate fabrics to such an extent that they can be dyed with direct cotton colors. The practice is not to be recommended or condoned for the reasons noted above.

When cellulose acetate fabrics are treated with highly alkaline liquors under correct conditions, the outside of each individual filament is partially saponified. This results in what is essentially a coated fiber—a cellulose acetate fiber coated with a thin layer of regenerated cellulose. The cellulose acts as an insulating material and partially protects the cellulose acetate core from the action of the heat. Thus it is possible to produce a cellulose acetate fabric that can be successfully ironed without special precautions by the housewife. "Iron-Proofed" fabrics have been produced that show no evidence of softening when treated at 550 degrees F. for ten seconds with an ordinary household iron. (Ordinary cellulose acetate fabrics will melt and shrivel at about 460 degrees F.—they become stiff and "boardy" at 420 to 440 degrees F).

There are three general methods of Iron-Proofing cellulose acetate in the piece, procedures for which are given below. Although these procedures have been used to successfully produce large quantities of Iron-Proofed fabric, we do not mean to say that these procedures will work equally well on all types of fabric and under all conditions.

Iron-proofing Procedure

Acetate Fabric

(1) Boil off fabric as usual.
(2) Prepare Iron-proofing tank by adding one pound of caustic soda to each thousand gallons of water.
(3) Suspend the boiled off fabric from the selvages in the Iron-proofing tank for 12 to 18 hours. Start at 140-160 degrees F. Run fabric in gradually cooling bath.
(4) Rinse, dye, and finish as usual.

Iron-proofing Procedure

Acetate Fabric

When many consecutive batches of the same shade are required it is possible to iron-proof by adding four to ten percent (based on the weight of the goods) of caustic soda to the dye bath—making no other change from the normal dyeing procedure.

This is possible only when the dyeing procedure is well established and when shading is not necessary. Ob-

viously, variations in dyeing time will produce variations in the degree of iron-proofing, in the hand, appearance, etc. of the finished fabric.

Iron-proofing Procedure

Acetate Fabric

(1) Scour as usual.
(2) Dry.
(3) Pad fabric with a dilute caustic soda solution.
(4) Run continuously on drying cans without washing off the alkali.
(5) Dye and finish fabric as usual.

Caustic concentration and dry can temperature are dependent one upon the other. Increasing caustic concentrations and increasing dry can temperatures increase the degree of iron-proofing and decrease the weight of the finished fabric as well as detract materially from the pleasing properties usually accruing from the use of cellulose acetate yarns.

Although cotton fabrics containing cellulose acetate can be successfully mercerized, the procedure has never become general because few finishing plants care to use a process that requires such careful control. The acetate containing fabrics that have been successfully mercerized on a semi-commercial scale have been treated by mercerizing processes tempered along one of the three following lines:—

1. Buffered solutions.
2. Low temperatures.
3. Use of special alkalis.

Acetate and regenerated cellulose combination fabrics are sometimes dyed into acetate white and cross dye effects in vat dye baths.

Care must be taken that the dyestuffs used to color the regenerated cellulose portions of the fabric are those that do not stain acetate and are colors that can be applied in a bath made only slightly alkaline. The use of too much alkali in the bath will cause the acetate portion of the fabric to become partly saponified, and thereby stained or dyed by the vat color. This method of dyeing calls for very careful supervision in order to assure the production of a high percentage of satisfactory merchandise.

It is possible to apply sulfur dyestuffs to acetate containing union fabrics if special precautions are used. The use of sulfur dyes is made possible by the substitution of hydrosulfite for part of the sodium sulfide and by the addition of sodium acetate as a buffering medium. The above described method of dyeing acetate unions has not and is not likely to become general.

Cellulose acetate is unquestionably the most difficult of the commercial fibers from the viewpoint of the printer. In fact certain phases of printing technique with respect to cellulose acetate fabrics have not yet been satisfactorily worked out. For example, heavy shades on cellulose acetate fabrics cannot yet be satisfactorily discharged in many printing plants.

The extreme susceptibility of cellulose acetate yarns to the action of hot alkaline solutions and pastes greatly handicaps men engaged in the printing of these fabrics.

Soaps

In the foregoing discussion of the effect of alkali on cellulose acetate no mention has been made of the delustering effect sometimes produced by these alkalies. It is an unfortunate fact that hot alkaline liquors will cause cellulose acetate yarns to become delustered particularly when soaps or sulfonated oils are present in the bath.

The delustering effect of soap, sulfonated oils, and alkalis on cellulose acetate fibers has not yet been satisfactorily explained from either a physical or chemical viewpoint. Examination of a photomicrograph of soap delustered acetate yarn will show that the soap has caused a heterogeneous structure or arrangement within the acetate fiber itself. Whether this is due to the inclusion of globules or water within the fiber or to a partial physical or chemical breakdown of the fiber substance or to some other cause has not as yet been satisfactorily determined.

Whatever the cause of the delustering action of soap on cellulose acetate may be, the observed effects are as follows:—

(1) The weight of the delustered fabric is relatively unchanged. Some investigators claim a slight increase in weight, others a slight decrease.
(2) The shape of the delustered filament, as observed by examination of the same under the microscope, is unchanged.
(3) The delustered effect is not caused by action of soap on the surface of the fabric as microscopical examination discloses a globular like structure within the filament. That is, under the microscope, delustered cellulose acetate rayon appears to have been delustered by the inclusion of small particles of some substance within the interior of the individual filaments.
(4) The delustered yarn does not stain any more readily with viscose dyes.
(5) By use of proper chemicals the delustered acetate rayon may be re-lustered.

In order to prevent cellulose acetate fabrics from becoming delustered during the scouring and dyeing operations these fabrics should be processed *at or below* 180 *degrees F. when soap or alkalies are present in the wet treating liquors.* Careful observation of this precaution will prevent cellulose acetate fabrics from being delustered during the scouring and dyeing procedures.

The delustering effect of soap, soluble oils and alkalis at elevated temperatures when applied to cellulose acetate yarns and fabrics; usually considered a drawback, is sometimes utilized as an asset by dyers and finishers of flat woven acetate fabrics. In many instances it is possible to deluster flat woven acetate fabrics successfully in machines capable of handling the same in open widths.

The procedures used to produce delustered acetate fabrics vary with the type of fabric processed and the type of apparatus available for treatment. These processes

depend upon the fact that acetate fabric becomes slowly delustered when treated above 180 degrees F. with soap and sulfonated oil solutions.

Fabrics delustered as described above are stiffened somewhat by the treatment. Fortunately acetate fabrics possess such excellent draping qualities that the stiffness caused by the delustering treatment does not render them unmerchantable or cause them to have an undesirable feel.

Soluble Oils

Sulfonated oils are often used in the scouring of acetate fabrics either in conjunction with soap or in the place of soap. The "hand" of certain types of acetate fabric is appreciably improved by wet processing in sulfonated oil rather than soap baths. This is undoubtedly due to the fact that part of the sulfonated oils are absorbed and tenaciously retained by the surface of the cellulose acetate filaments.

The action of sulfonated oils on cellulose acetate yarn and fabrics, at elevated temperatures, is the same as the action of soap, with the exception that the action is, of course, more mild.

Solvents

The action of solvents on cellulose acetate yarns and fabrics is not of especial interest to dyers and finishers as they need only avoid the use of solvent containing materials to completely remove all danger from solvents in-so-far as they are concerned. Some of the solvent-containing scouring materials on the market do not effect acetate fabrics disadvantageously, and may be safely used as additions to acetate scouring baths. It is a simple matter for the dyer of acetate-containing materials to test individual solvents containing scouring materials on acetate fabric before processing.

Use of the wrong solvents as "spotting agents" on the loom sometimes causes trouble in the dye house. Such agents effectively remove oil and grease from the fabric, but so effect the cellulose fiber substance that the stains show up after dyeing.

For spotting purposes, carbon-tetra-chloride has been found to be satisfactory. Even this solvent should not be used indiscriminately—care should be taken that the solvent has been entirely evaporated from the fabric before the same is allowed to roll up upon the take-up beam.

It is in the dry cleaning industry that the action of solvents on cellulose acetate rayon becomes of especial importance. When cellulose acetate was first introduced, dry cleaners experienced losses amounting to many thousands of dollars, due to the use of improper "spotting" agents on acetate and acetate containing garments.

Current losses have been reduced to a minimum by the very excellent research on this problem carried out by the National Association of Dyers and Cleaners.

The subject of cellulose acetate solvents has been very thoroughly discussed from a different viewpoint by Dr. Cyril J. Stand "Technology of Cellulose Acetate with Reference to Plastizers and Solvents."

We would like to emphasize the statement made therein that the mixing of two-non-solvents sometimes results in the formation of a solvent for cellulose acetate. Lack of understanding of this fact often causes difficulties in the dry cleaning industry.

Acids

Cellulose acetate rayons are much more resistant to the action of dilute acids (the concentrations customarily used in dye baths) than are the regenerated cellulose type of rayons. The acid concentrations ordinarily used in dyeing work will not injure cellulose acetate.

Concentrated acids completely destroy cellulose acetate rayons. Depending upon the acid used, concentrated acids destroy cellulose acetate rayons by solvent action, by degradation, by oxidation, or by carbonizing.

The acid concentrations customarily used in scrooping procedures will not injure cellulose acetate rayons in any way.

Peroxide

Hydrogen peroxide has been successfully used as a bleaching agent for cellulose acetate fabrics. Extreme care is necessary during the peroxide bleaching process as cellulose acetate fabrics are weakened if treated at high temperature with moderately strong peroxide baths.

Hypochlorites

Obviously, the use of *alkaline* sodium hypochlorite solutions must be avoided as the free alkali contained therein is sufficient to cause saponification.

Neutral and slightly acid sodium hypochlorite solutions provide the best bleaching baths for cellulose acetate fabrics, particularly when acetate is used in conjunction with cotton. When acid hypochlorite solutions are used, care should be taken that the temperature of the bleaching bath is maintained as low as possible.

Potassium Permanganate

Correctly handled, potassium permanganate can be used as a bleaching agent for cellulose-acetate-containing textiles. The permanganate process receives little commercial application.

Sodium Bisulfite

All statements made under the heading of regenerated cellulose rayons in the first section of this chapter apply equally well upon cellulose acetate materials.

Hydrosulfites

The hydrosulfites can be used in conjunction with cellulose acetate rayons provided that care is observed that they are not applied in alkaline baths at or above 180 degrees F.

Sodium hydrosulfite has been very successfully used in neutral solutions for the bleaching of acetate fabrics.

It is at once obvious that the printer of acetate containing fabrics is seriously handicapped with respect to the application of hydrosulfite and related compounds to acetate containing fabrics as he cannot use the customary quantities of alkali and must therefore change printing pastes when cellulose acetate fabrics are processed.

For further details regarding hydrosulfites, read the discussion given under this heading in the regenerated cellulose section of this chapter.

Titanous Stripping Agents

Titanous stripping agents are occasionally used in conjunction with cellulose acetate fabrics as these agents destroy certain dyestuffs that other stripping compounds will not. Whenever possible, it is better to use a milder stripping agent as titanous stripping agents can readily deluster acetate fabrics as well as cause the same to be seriously tendered.

Diazotizing and Developing Baths

The ordinary diazotizing and developing baths used in conjunction with cotton and regenerated cellulose rayons can be safely used on acetate containing fabrics provided that care is taken to maintain the alkaline concentration of the developing baths as low as possible.

Diazotizing and developing baths necessary to properly develop the special acetate dyestuffs requiring this treatment unfortunately must be run at higher temperatures and for longer periods of time than are ordinary diazotizing and developing used in conjunction with cellulose acetates is a decided disadvantage. The increased time consumed by the diazotizing and developing baths used in conjunction with cellulose acetate fabrics is in itself a very serious disadvantage, particularly in the case of commission dyeing and finishing establishments.

A still more serious disadvantage is the effect of light on many of the diazo compounds. Streaks are apt to result, particularly when direct sunlight comes into contact with such fabrics during the processing operations.

Indeed, trouble is sometimes encountered from mechanical abrasion alone due to the softening effect of the prolonged running necessitated by this process.

The above described troubles have caused dyers of cellulose acetate fabrics so much grief that most of them prefer to use the direct dyeing colors even at increased dye costs.

The affinity of cellulose acetate for organic bases has been utilized by many dyers in the production of economical fast dyed fabrics. For example, amino diphenylamine has a very marked affinity for cellulose acetate and can be used in the production of a very pleasing black, by the utilization of an ageing operation after dyeing.

A second example is the application of dianisidine to the fiber and the production of various shades by diazotizing and coupling to different developers.

See pages (278-279) for announcement regarding the Annual Meeting of the American Association of Textile Chemists and Colorists.

TEXTILE FOUNDATION NEWS

(Continued from page 290)

The result is a septic condition in the stream, foul odors, unsightly appearance, and water generally unfit for domestic or even industrial use.

"Discharging the wastes into sewers and depending upon the sewage treatment plants to care for them is usually unsatisfactory and often disastrous. The majority of sewage disposal plants employ the same microorganisms that the stream depends upon in caring for its pollution. Accordingly, the same limitations apply and the disposal plant often does not adequately clarify or purify the wastes.

"Our research at the University of North Carolina is directed at the determination of textile manufacturing waste disposal methods which will accomplish their purpose efficiently and economically, removing color, organic matter and objectionable chemicals," said Mr. Campbell, in summarizing the objective of his investigation for the Textile Foundation.

"We must determine whether one method of treatment can be developed to care for all combinations of wastes, whether it is possible to obtain from the process by-products such as fertilizers, gas or even recovered dyes or chemicals that will help defray the costs of disposal, and whether textile waste disposal can be combined satisfactorily with domestic sewage treatment so that municipalities can reasonably be expected to share the expense, as many are willing to do."

Fashion Shades, Summer, 1933

In Sample Card No. 1031 the Society of Chemical Industry in Basle shows 77 fashion shades on ladies' goods, which have been produced by means of Neolan and level-dyeing acid dyestuffs. In this new edition, the fashion shades for summer, 1933, have been presented in the latest approved manner.

The dyeings have been made with those Neolan dyestuffs having the best levelling properties and fastness to light and only such brilliant acid dyes have been used as are necessary for brightening. Each separate shade has been taken into consideration regarding the requirements of fastness to light, perspiration, sea water, water, washing and resistance to wear. These dyes are distributed by the Ciba Company.

MODERN IDEAS ON THE STRUCTURE OF CELLULOSE

(Continued from page 268)

Hydrate cellulose is characterized by the fact that it shows all the properties of ordinary cellulose in an exaggerated degree with the exception that there is no change in copper number, unless the swelling has also been accompanied by hydrolysis.

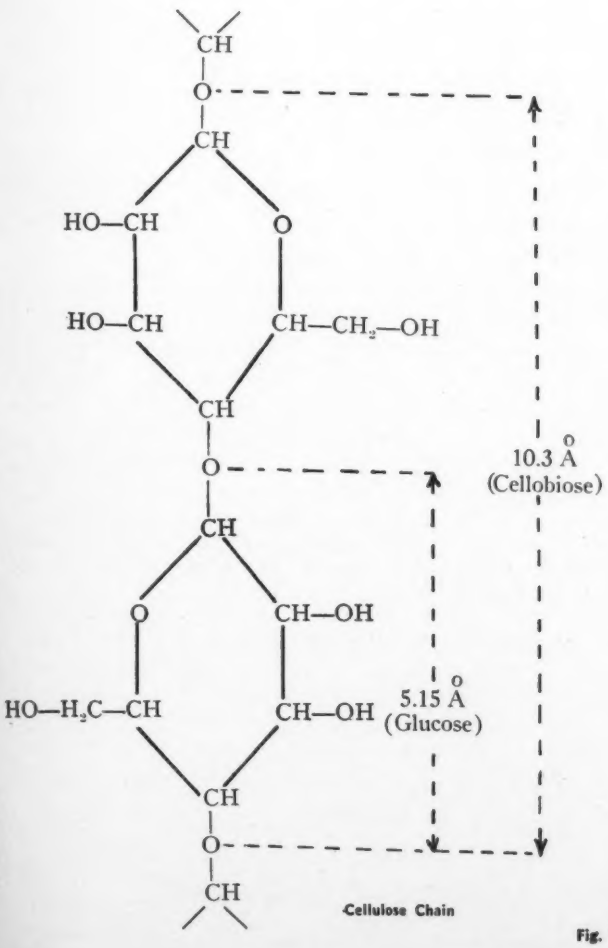
Some of these properties are:

1. Increased capacity for the absorption of water—part of this increased capacity may be removed by drying the hydrate cellulose.
2. Increased capacity for the absorption of sodium hydroxide and barium hydroxide. This has been proposed by Neale as a test for the extent of hydration of cellulose.
3. Greater iodine absorption.
4. Increase absorption of direct dyes.
5. Increased solubility in ammoniacal copper oxide.
6. Increased reactivity to sodium hypobromite.

The X-ray data on hydrate cellulose in the form of mercerized cotton is quite illuminating. The following values of the recurring periods, expressed in Angstrom units, have been obtained:

	Native Cotton	*Mercerized Cotton*
a.	8.35	8.1
b.	10.3	10.3
c.	7.9	9.1

This shows that on mercerization, the longitudinal period (b) remains unchanged, one transverse period (a) is practically unchanged, while the other transverse period (c) is made larger. Evidently the long chain of glucose residues is unbroken, since the copper number remains the same. The idea which best explains both the X-ray data and the properties listed above is that the swelling permanently shifts the planes of molecules apart and therefore makes the hydroxyl groups of the cellulose, in which all the reactivity seems to center, more readily accessible to reagents and consequently more reactive.



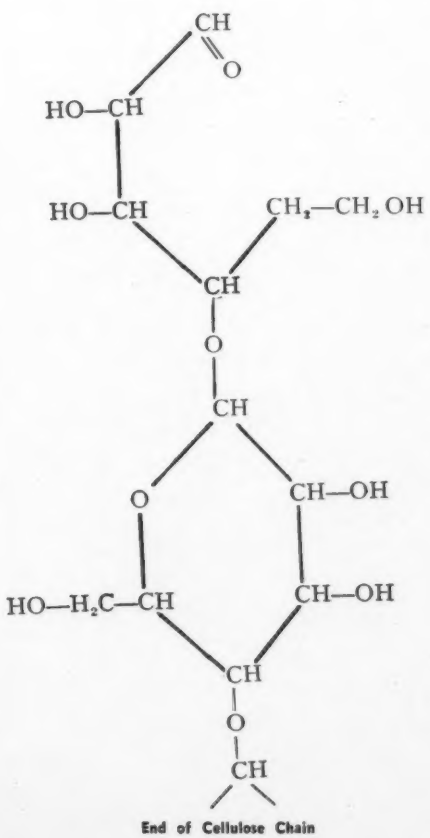


Fig. 3

It may be seen from the foregoing survey, that the problem of cellulose chemistry is one of both chemistry and physics; that the chemical properties of the material are limited by its physical properties; and that the physi-

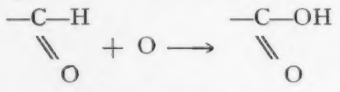


Fig. 4—Oxidation of Aldehyde to Acid

cal properties are to a certain extent the result of its chemical properties. Until the new chemistry rests upon a more solid groundwork of established facts, progress in the chemistry of such a complex substance as cellulose will necessarily be slow.

Bradford Durfee Alumni

A meeting of the New York Section of the Bradford Durfee Textile School Alumni was held on April 7th at the Cabin Grill in New York City. About thirty-five alumni, representing nearly every branch of the textile industry, attended. Very interesting addresses were delivered by L. Brassel, U. S. Testing Co., S. J. Lovit, National Aniline & Chemical Co., and R. Helfanheim, Cohn-Hall-Marx Co. The next regular meeting will be held at the same place on 490 Seventh Ave., the evening of May 17th. Arthur E. Jerome, '22, presided.

Chlorantine Fast Colors

Sample card No. 975 of the Society of Chemical Industry in Basle, contains 49 type dyeings in two shades on Viscose yarn. The series of Chlorantine Fast Colors has been enriched of late by the addition of a number of products said to be of very good fastness to light, so that a new classification was made necessary with respect to light fastness (see circular No. 362.) Hence the Chlorantine Fast Colors of the best light fastness have been given the designation LL.

In this card the dyestuffs illustrated have been designated according to the new grouping.

It is claimed that the Chlorantine Fast Colors make possible the production of shades fast to light, in the simplest manner. They are also said to be especially adapted for the dyeing of Rayon yarns, for the production of decorative fabrics such as draperies and upholstery goods or sun-fast knit goods, piece goods, curtains, velvets with Rayon pile etc. It is further claimed that Chlorantine Fast Colors are also well suited for dyeing mixed fabrics of cotton and rayon. There is also a selection for discharge printing.

The Chlorantine Fast Colors most suitable for the production of combinations having the best fastness to light are designated as well as those best suited for dyeing level on streaky Viscose.

New Patents

(*Abstracted by Synth. Org. Chem. Mfrs. Assn.*)

Process of Making Dyestuffs of the Polymethine Series and new Intermediate Products Therefor. (Obtained from cyclic ammonium salts having a methyl-group; dye cotton mordanted with tannin, or silk, pink to violet-red tints; new intermediate products also useful for pharmaceutical purposes.) Richard Kuhn, of Zurich, and Walter Kern, of Sissbach, Switzerland, assignors to the firm: Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,886,485, Nov. 8, 1932.

Naphthalimide Dyestuffs and Processes of Preparing Them. (Comprises heating an aqueous solution of 4-bromo-sulfo-naphthalic acid anhydride with ammonia under super-atmospheric pressure; yield very clear greenish-yellow to reddish-orange tints of good levelling power.) Wilhelm Eckert. of Frankfort-on-the-Main-Hochst, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,886,797, Nov. 8, 1932.

Arylated Safranines and Process of Preparing Them. (Dye silk and tanned cotton fine violet to sky-blue tints of good fastness.) Fritz Hess, of Frankfort-on-the-Main-Hochst, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,886,809, Nov. 8, 1932.

Manufacture of Strongly Basic Azodyestuffs. (Comprises treating aminated sulpho-free monoazodyes successively with chloracetyl-chloride and pyridine; dye tannin-mordanted cotton, weighted silk and leather goods tints fast to washing and light.) Achille Conzetti, of Basel, Switzerland, assignor to the firm J. R. Geigy S.A., of Basel, Switzerland, No. 1,887,289, Nov. 8, 1932.

CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

Turn those odd lots of dyestuff into cash. Opportunity to liquidate your surplus stock of dyes. Let me know what you have on hand and I will put you in contact with a buyer on a 10% commission basis. Inquiries for job lots also solicited—Charles J. Rupp, (formerly of Kalle-Newport-DuPont), 420 State St., Brooklyn, N. Y.